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Armitage (H. M.). **Possible economic Relations of the Hawaiian Insect Fauna to California Agriculture.**—*Pan-Pacif. Ent.* **19** no. 1 pp. 1–11, 11 refs. San Francisco, Calif., 1943.

In view of the increase in the volume and rapidity of transport from the Hawaiian Islands to the mainland of the United States, the larger number of arrival points, owing to the use of aircraft, and the employment in this area of personnel unfamiliar with the local pest problems, largely owing to war conditions, the author discusses some of the insects that are pests in the Islands and might be equally injurious in California and calls attention to others that might become important if introduced, and ways in which insects might be transported. The review is based on regulations against recognised pests in Federal and State quarantines, on papers and reports by Hawaiian entomologists, and on records of insects from Hawaii intercepted during quarantine inspections at San Francisco.

[**Insect Pests in New Mexico in 1940-41.**]—*52nd Rep. New Mexico agric. Exp. Sta. 1940–41* pp. 48–62, 2 figs. State College, N.M. [1941 (Recd. 1943).]

Work on *Cydia pomonella*, L., and its control on apple was continued [*cf.* *R.A.E.*, A **30** 399]. A spray schedule comprising a calyx and three cover sprays of lead arsenate against the larvae of the first three generations followed by two of nicotine bentonite against the fourth-generation larvae was compared with one in which cryolite was substituted for lead arsenate in the second and third cover sprays. Frost interfered with the results on three varieties, but on a fourth the schedules including cryolite were the less effective. The inclusion of a supplementary first cover spray of lead arsenate in either schedule did not consistently decrease the percentage of calyx entries, though on two varieties the percentage of sound fruit was slightly increased in the cryolite series. Statistical analysis showed that all sprays gave significant control as compared with untreated trees. At harvest, the arsenic residue on fruits that had been treated with cryolite varied from 0·0053 to 0·0104 grain per lb.; that on the others exceeded the legal tolerance (0·025), but was brought below it by washing in standard acid solution in a flotation washer without brushes. A lead-arsenate schedule in which the nicotine bentonite was replaced by a spray of rotenone dust and derris extract gave the best results on two varieties, but was least effective on the third. No increase in the control given by the standard schedule was effected by the addition of brown sugar and Certo to the second and third cover sprays in an attempt to render the lead arsenate attractive to the larvae [*cf.* **29** 129].

In experiments with baits for the adults, the standard bait of a 10 per cent. solution of commercial sugar-cane syrup in distilled water was rendered considerably more effective by the addition of pure or mixed cultures of *Aerobacter aerogenes* and *Aerobacillus polymyxa* [*cf.* **29** 414]. The bait with the pure culture of *Aerobacter* was much the most effective, catching over four times as many moths as the standard. Each culture in syrup was also more effective than it was in a 10 per cent. solution of dextrose or sucrose in distilled water containing 1 per cent. peptone to provide the proteins necessary for normal bacterial growth, but *Aerobacter* with sucrose and *Aerobacillus* with dextrose were more effective than the standard, whereas either bacterium with the other sugar was less effective. Mixed cultures of both species with either sucrose or dextrose were less effective than any of the other baits. Eleven volatile acids known to be formed by these bacteria during the fermentation of carbohydrates were emulsified with glycerine and gum tragacanth [**30** 399] and tested as baits in the orchard and by noting the proboscis response of moths in the laboratory.

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Ten of them were less effective than cane syrup as baits, and the other, though slightly more effective, elicited no proboscis response in the laboratory.

Work on the control of *Paratrioza cockerelli*, Šulc, on potato was also continued [*cf.* **30** 400]. In comparative experiments with yellow dusting sulphur and liquid lime-sulphur, each applied alone or in combination with nicotine or an arsenical, the highest yields (33,070 and 32,686 lb. per acre) followed applications of a spray containing 2 gals. liquid lime-sulphur and 1 pint nicotine sulphate in 100 gals. water and yellow dusting sulphur alone, respectively ; the highest percentage of first grade tubers was obtained from plants receiving the dust. Yellow dusting sulphur applied at intervals of 7, 10 or 14 days gave higher yields than weekly applications of lime-sulphur alone, and the yields increased with the frequency of the applications. When different types of sulphur dust, yellow dusting sulphur in combination with copper fungicides, pyrethrum or dry lime-sulphur, and a spray of wettable sulphur alone or in combination with a copper fungicide were compared, yellow dusting sulphur to which was added 6 per cent. of a proprietary brand of yellow cuprous oxide produced the highest yield (25,021 lb. per acre). All the dusts, except one containing 50 per cent. yellow sulphur dust, 25 per cent. monohydrated copper sulphate and 25 per cent. hydrated lime, were superior to wettable sulphur. The results of all the experiments on the control of *P. cockerelli* were statistically significant.

HUTSON (R.). **Spraying for Control of Grapeberry Moth and Grape Leafhopper.**—*Quart. Bull. Mich. agric. Exp. Sta.* **24** no. 4 pp. 287–290, 1 fig., 2 refs. East Lansing, Mich., 1942.

The value of spray schedules including calcium arsenate and fixed nicotine against the grapeberry moth [*Polychrosis viteana*, Clem.] and the grape leafhopper [*Erythroneura*] in Michigan [*R.A.E.*, A **29** 117, 558] was confirmed in 1941, and experiments were made to determine the number of applications of each insecticide required for effective control. Schedules comprising 5–1 applications of calcium arsenate followed by 0–4, respectively, of fixed nicotine (Black Leaf 155) all gave good control of *Polychrosis* in lightly and heavily infested vineyards. The schedules including 3 or more sprays of calcium arsenate were particularly effective and differed little in efficiency. Any schedule involving two or more applications of fixed nicotine has been found to give good commercial control of *Erythroneura*, and two applications of this insecticide are more effective than one of nicotine sulphate because of the difficulty of timing the latter. From the work as a whole, a schedule comprising three applications of a spray containing 3 lb. calcium arsenate and 3 U.S. quarts oil, as a sticker, per 100 U.S. gals. water, followed by two containing 3 lb. Black Leaf 155 (14 per cent. fixed nicotine) and ½ lb. fish-oil soap, appears to be suitable, but there is evidence that the addition of ¾ U.S. pint nicotine sulphate to the second and third sprays, which are applied just before and after blossoming improves control if infestation is heavy. The arsenic residue on the fruit at harvest was below the legal tolerance.

Conflicting data on the value of sprays applied after 24th August against *P. viteana* were obtained in 1939 and 1940, but in a test in 1941 a significant increase in the percentage of undamaged grapes followed a late application of fixed nicotine. Late sprays are effective only when properly timed, and the trend of the adult population should therefore be observed by means of bait pots containing a mixture of 3 oz. brown sugar or molasses and 15 drops oil of sassafras in 1 U.S. quart water. The vines should be sprayed soon after a large increase in the number of moths trapped later than August 15th.

HUTSON (R.) & SHERMAN III (F.). **Controlling Rose Chafer.**—*Quart. Bull. Mich. agric. Exp. Sta.* **24** no. 4 pp. 292–294, 1 fig. East Lansing, Mich., 1942.

Experiments in Michigan had shown that pyrethrum was toxic to adults of the rose chafer [*Macrodactylus subspinosus*, F.], which are injurious to flowers and fruit trees, but that sprays containing it were not effective, since no known wetter would make them wet the surface of the beetles. Work in 1941, however, showed that mannitan monolaurate (NNO) was satisfactory for this purpose ; beetles that were hit by a spray of pyrethrum extract and this wetter fell from the trees within a few minutes, and none survived. Apple, peach and pear trees that had been freed from them were effectively protected from re-infestation by the application within 48 hours of a spray of 25 lb. lime with 5 lb. bentonite-sulphur as an adhesive per 100 U.S. gals., and sweet cherry and young apple trees (which are injured by sprays containing more than 15 lb. lime per 100 U.S. gals.) by dusting daily with a pyrethrum dust.

TRAVIS (B. V.). **Further Tests with Thallium Baits for Control of the Fire Ant.**—*J. econ. Ent.* **36** no. 1 pp. 56–58, 4 refs. Menasha, Wis., 1943.

In further field tests with poison-baits for the control of *Solenopsis geminata*, F. [*cf.* *R.A.E.*, A **28** 361], 595 colonies in a plantation in Florida were each treated in March 1939 with 20 gm. of a bait of sugar, water and cane syrup (16 : 16 : 1) containing 0·5, 1, 1·5, 2 or 3 per cent. thallium acetate or 0·5, 1 or 1·5 per cent. thallium sulphate applied in a small aluminium bait can that was buried in the colony mound and covered with soil, or mixed with sawdust or excelsior and placed on the mound. Observations at the time of treatment and three days later showed that the ants fed freely on all the baits ; two weeks after application, large numbers of dead and sluggish ants were noted in most of the colonies ; and two months after, 83 per cent. were completely destroyed, 8·7 per cent. were partly destroyed and the remainder appeared normally active. After 8 months, a slightly larger number of active colonies was observed, but the percentages were not materially changed. The percentages of colonies inactive after 2 months were 65, 94, 84, 75 and 89 for thallium acetate at the five concentrations, respectively, and 78, 88 and 84 for thallium sulphate. Statistical analysis of the results showed that 1 per cent. thallium acetate was significantly better than all other concentrations except the highest, that there was no significant difference between the three concentrations of thallium sulphate and that application by can was significantly superior to the other methods. Examination of the treated plots one year after application showed a reinfestation equal to 58 per cent. of the original population, due principally to migration and the formation of new colonies. Although the bait cans gave somewhat better control, the use of sawdust with thallium poisons is recommended because less time is required for distributing the baits and the cost of the containers is eliminated. The treatment should be applied in spring, when the top layers of soil are moist and warm and the lower ones still cool, since at that time the ants congregate in the top few inches of the mound and will feed readily on the baits.

HOWARD (N. F.) & APPLE (J. W.). **Toxicity of Cube-Vegetable Oil Dusts to two Species of Aphids.**—*J. econ. Ent.* **36** no. 1 pp. 59–62, 9 refs. Menasha, Wis., 1943.

In comparative experiments to determine the toxicity of dusts of cubé combined with certain vegetable oils to *Myzus persicae*, Sulz., on turnip and *Aphis gossypii*, Glov., on okra [*Hibiscus esculentus*], small leaves bearing 50–100 mature Aphids, from which predators and parasitised individuals had been removed, were treated with cubé or nicotine dust at one-third of the strength used in the field and kept at 70°F. and a relative humidity of 50 per cent. for two days to determine Aphid mortality. The dosage (dust deposit per unit area) was also determined. The cubé (4·2 per cent. rotenone and 14·2 per cent. total extractives) was diluted with talc to contain 0·25 per cent. rotenone and applied alone or with the addition of 1 per cent. ground-nut, olive, grapefruit-seed or soy-bean oil. Two nicotine dusts were prepared from nicotine sulphate (40 per cent.) and hydrated lime to give 0·67 and 1·33 per cent. nicotine. As shown by the calculated median lethal doses, the toxicity of cubé to *A. gossypii* was increased significantly by the second two oils and non-significantly by the first two; the median lethal dose for *M. persicae* also appeared to be reduced by the addition of the oils. Sodium oleyl sulphate as a conditioner slightly increased the effectiveness of cubé alone, but not that of cubé with ground-nut oil. A dust containing 0·33 per cent. cubé and 16·67 per cent. each of tobacco dust and sulphur, which was tested against *M. persicae* only, was about as effective as 0·25 per cent. cubé alone. The nicotine dusts were the least effective; they caused an immediate knock-down, but most of the Aphids recovered in two days. *M. persicae* appeared to be more resistant to the dusts than *A. gossypii*.

HILL (R. E.) & TATE (H. D.). **Increases in Aphid Populations on Potato Plants sprayed with Zinc Arsenite in western Nebraska.**—*J. econ. Ent.* **36** no. 1 pp. 63–66, 10 refs. Menasha, Wis., 1943.

The results are given of observations made in western Nebraska in 1941 on the increase of *Myzus persicae*, Sulz., on experimental potato plantings that had been treated with a spray of zinc arsenite and lime-sulphur for the control of *Epitrix cucumeris*, Harr., and *Paratrioza cockerelli*, Šulc, and of additional investigations made in 1942 to determine more clearly the effect of different treatments on the Aphid populations. Zinc arsenite (40·3 per cent. As_2O_3) was applied in a spray, usually at a concentration of 2 lb. in 40 U.S. gals. spray with the addition of 1 U.S. gal. liquid lime-sulphur, and Dutox (72 per cent. barium fluosilicate and 8 per cent. sodium fluoaluminate) as a dust in sulphur (usually 1 : 4) 1–4 times between 6th July and 23rd August. The results, which were estimated by sweeping the plants with an insect net and counting the Aphids on leaf samples, showed that although various species of Aphids were present, *M. persicae* was the only one that occurred in significant numbers, and that the population, in both treated and untreated plots, remained at a very low level until towards the end of August, after which there was a marked increase that continued until freezing temperatures occurred. The rate of increase was significantly higher on plants treated with zinc arsenite, particularly where two or more applications were made, than on untreated ones; some increase seemed to occur on plants treated with Dutox, but it was relatively slight. The lime-sulphur in the spray and the sulphur in the dust were shown to have no significant effect on the Aphid populations.

Although comparatively unimportant on potatoes grown for the table, increases in the numbers of Aphids are serious where potatoes are grown for seed, since they transmit virus diseases. Direct control by means of aphicides is complicated by the fact that the population increases late in the season, when the use of machinery would cause serious damage to the plants, but the use of barium fluosilicate dust, which is as effective as zinc arsenite for the control of *E. cucumeris*, may prove satisfactory.

STEINER (L. F.), ARNOLD (C. H.) & FAHEY (J. E.). **Soybean Phosphatides as Deposit-builders in Nicotine Bentonite and Lead Arsenate Spray Mixtures for Control of the Codling Moth.**—*J. econ. Ent.* **36** no. 1 pp. 70–72, 4 refs. Menasha, Wis., 1943.

In the course of laboratory experiments in Indiana in 1941 with sprays against larvae of the codling moth [*Cydia pomonella*, L.], it was found that sprayable inverted mixtures of crude soy-bean oil and nicotine bentonite, in which the particles of solid, originally suspended in the aqueous phase of the emulsion, became wet by the oil, could be made without the addition of soap, the crude phosphatides, which are usually precipitated in soy-bean oil by moisture and low temperatures and contain 40–60 per cent. material insoluble in acetone, being largely responsible for inversion. Deposits of 3·8 and 3·5 mg. nicotine per sq. cm. were obtained when apples were exposed for four seconds once and three times at intervals of 26 seconds, respectively, to a spray of 5 lb. nicotine bentonite, prepared dry in the proportion of 1 U.S. quart nicotine sulphate (40 per cent. nicotine) to 10 lb. powdered Wyoming bentonite, and 2 U.S. quarts mineral oil per 100 U.S. gals., and 8·9 and 17 mg. when 2 U.S. quarts crude soy-bean oil (0·11 lb. acetone-insoluble material per 100 U.S. gals.) was substituted for the mineral oil ; and deposits of 10·3 and 15·6 mg. arsenic trioxide per sq. cm. given by a spray of 3 lb. lead arsenate, 0·5 lb. copper sulphate, 1 lb. hydrated lime and 2 U.S. quarts kerosene per 100 U.S. gals. were increased to 17·8 and 38·1, 29·5 and 75·3, and 29 and 79 by dissolving crude phosphatides in the kerosene to give 0·25, 0·5 and 1 lb. acetone-insoluble material per 100 U.S. gals. spray. The quantity of phosphatides required to bring about inversion was affected by agitation and the total surface area of the solids in the spray mixture, a micronised factory-processed nicotine bentonite requiring more than the regular grade of identical chemical composition and lead arsenate with Bordeaux mixture still more, but not apparently by water hardness. The swelling property of Wyoming bentonite in the dry-mix nicotine bentonite was destroyed by mixing the nicotine sulphate with the bentonite before the mixture was dispersed in water, and this mixture could be made to build deposits with the addition of relatively small amounts of the phosphatides. By utilising a Mississippi bentonite of low swelling value, but having nicotine-combining properties equivalent to Wyoming bentonite, a promising tank-mix formula was devised, 3 lb. bentonite, 0·83 U.S. pint nicotine sulphate, 2 U.S. quarts crude soy-bean oil containing 0·19 lb. acetone-insoluble material and 0·25 lb. zinc sulphate per 100 U.S. gals. spray depositing 10·6 and 22·6 mg. nicotine per sq. cm. after 4 and 12 seconds of spraying, respectively. The addition of monohydrated zinc sulphate to dry-mix nicotine bentonite permitted a reduction in the amount of agitation or of phosphatide required ; although not essential in mixtures with soy-bean oil, this or other inorganic salts were found to be necessary for the best results when mineral oil was used. Additional inorganic salts are not necessary in inverted sprays of lead arsenate, but it is considered that Bordeaux mixture, zinc sulphate or zinc sulphate and lime should be included to prevent arsenical injury.

Although the phosphatides can be separated from soy-bean oil or the marketed crude material and used in this form, the best results have been obtained by dissolving the crude product directly in the oil ; there is some evidence that the free fatty acids in the crude phosphatides are also important.

SUMMERLAND (S. A.) & STEINER (L. F.). **Codling Moth Oviposition and Fate of Eggs.**—*J. econ. Ent.* **36** no. 1 pp. 72–75, 2 refs. Menasha, Wis., 1943.

The following is based on the authors' summary. During 1938, 520 marked bearing fruit spurs on 37-year-old apple trees in an orchard in Indiana were examined twice weekly. Of the 3,581 eggs of the codling moth [*Cydia pomonella*, L.] observed, only 6 per cent. were deposited on the fruit. On unbaited trees, about 60 per cent. were in the upper branches, but in the presence of bait traps, the rate of oviposition in tree-tops was approximately the same as that in the lower branches. On unsprayed trees, parasitism by *Trichogramma minutum*, Ril., averaged 32 per cent. in May and June and 43 per cent. from July to September. Only 37 per cent. of the first-brood eggs and 25 per cent. of those deposited in July–September hatched ; predators, believed to consist largely of *Chrysopa* spp., destroyed 19 per cent. of the first-brood and 23 per cent. of the second-brood. Approximately 10 per cent. of the eggs died or were lost.

Bait traps appeared to reduce parasitism slightly and to have no effect on predators. Cover sprays of lead arsenate or factory-processed nicotine bentonite containing 0·5 per cent. mineral oil appeared to reduce parasitism, but this reduction was offset by increased destruction of eggs by predators. Parasitism was greater and the destruction by predators less in trees sprayed with phenothiazine than in any other treated or untreated trees. Egg mortality was greatest on trees treated with mineral oil and lead arsenate or nicotine bentonite or with 0·5 per cent. soy-bean oil and tank-mix nicotine bentonite ; the disappearance of eggs was greatest where the deposits from spray treatments were heaviest. Both lead arsenate and tank-mix nicotine bentonite with soy-bean oil reduced oviposition, apparently by making leaf and fruit surfaces unattractive to gravid females rather than by keeping or driving the moths from the tree.

Gaines (J. C.) & Dean (H. A.). **The relative Effectiveness of Calcium Arsenates composed of large and of small Particles.**—*J. econ. Ent.* **36** no. 1 pp. 76–79, 1 fig., 4 refs. Menasha, Wis., 1943.

The authors describe field tests with dusts of commercial and special calcium arsenate, containing, respectively, 41·2–41·8 and 39·6 per cent. total arsenic pentoxide and 8·1–9·1 and 8·7 per cent. water-soluble arsenic pentoxide and with mean surface particle diameters of 1·1 and 2·7 microns, and a mixture of the special calcium arsenate with sulphur and cubé (75 : 15 : 10) containing 29·1 and 3 per cent. total and water-soluble arsenic pentoxide and 0·34 per cent. rotenone. They were applied 11 times at the rate of 8–9 lb. per acre between 24th June and 21st August in Texas against *Anthonomus grandis*, Boh., and *Heliothis armigera*, Hb., on cotton, and seven times at the rate of 6 lb. per acre between 28th June and 9th August in Louisiana against *A. grandis*. In both localities, their effects on *Aphis gossypii*, Glov., and *Adelphocoris rapidus*, Say, were also observed. Infestation records made at intervals of 5–7 days showed that the two calcium arsenates were equally effective against the weevil [*cf.* *R.A.E.*, A **30** 253] and more effective than the mixture, but they led to a significant increase in the Aphid population, whereas the mixture kept it at about the same level as on untreated plants. The commercial dust was most effective against the bollworm. The population of *Adelphocoris* was low, and only small differences occurred between treatments. The mixture gave the highest yield in Louisiana, owing to satisfactory Aphid control, whereas the commercial calcium arsenate gave the highest yield in Texas, where Aphids were not very injurious, because of good bollworm control.

In laboratory tests in which known doses of the two calcium arsenates were given to about 100 fifth-instar larvae of *Laphygma* (*Prodenia*) *eridania*, Cram., the coarser material was less effective than the finer one, the median lethal doses being 0·302 and 0·264 mg. per gm., respectively.

Gaines (J. C.). **Comparative Tests of certain Insecticides and Variations in Schedules for Cotton Insect Control.**—*J. econ. Ent.* **36** no. 1 pp. 79–81, 1 ref. Menasha, Wis., 1943.

Further tests of dusts against *Heliothis armigera*, Hb., and *Anthonomus grandis*, Boh., on cotton in Texas [*cf.* *R.A.E.*, A **30** 255] were carried out in 1941. Calcium arsenate containing 41·8 per cent. total arsenic pentoxide and 6·4 per cent. water-soluble arsenic pentoxide, a mixture of calcium arsenate and zinc arsenate containing 36·6 per cent. total arsenic pentoxide and 0·3 per cent. water-soluble arsenic pentoxide, and one of calcium arsenate and rotenone containing 36·6 per cent. total arsenic pentoxide, 10·8 per cent. water-soluble arsenic pentoxide and 0·27 per cent. rotenone, applied nine times between 1st July and 21st August at the rate of 8 lb. per acre, were equally effective against the weevil. The mixture of calcium and zinc arsenates was insignificantly more effective against the bollworm and significantly less effective against the rapid plant bug [*Adelphocoris rapidus*, Say] than the other treatments, and calcium arsenate with rotenone resulted in significantly lower infestation by Aphids [*Aphis gossypii*, Glov.] than the others. The yields indicated that the two mixtures were equally effective and better than calcium arsenate alone, but the differences were not significant ; all treatments gave a significant increase in yield over the controls.

On plots on which the dusts were applied at the rate of about 9 lb. per acre between 23rd July and 16th August, six applications of calcium arsenate were compared with four of calcium arsenate and two of either lead arsenate and clay (9 : 1), containing 29·2 per cent. total arsenic pentoxide and 0·12 per cent. water-soluble arsenic pentoxide, or a mixture of natural cryolite and sulphur (85 : 15), containing 75·7 per cent. sodium fluoaluminate. The lead arsenate or cryolite was used for two applications, applied consecutively at the peak of bollworm activity or alternated with calcium arsenate when bollworm injury was highest. The cryolite schedules were the least effective against either weevil or bollworm, and the lead-arsenate schedules the most effective against the bollworm. The schedules including lead arsenate in alternate and consecutive applications were more and less effective, respectively, against the weevil than six applications of calcium arsenate.

GAINES (R. C.). **Relation between Winter Temperatures, Boll Weevil Survival, Summer Rainfall, and Cotton Yields.**—*J. econ. Ent.* **36** no. 1 pp. 82–84, 2 refs. Menasha, Wis., 1943.

On the basis of yearly records from 1915 to 1941 of weather conditions, survival of the boll weevil [*Anthonomus grandis*, Boh.] in various hibernation shelters and estimates of yield of cotton in experimental plots and per planted acre in Louisiana, the author found significant correlation between the number of days from September to March on which the temperature fell below 32°F. and the number of live weevils found in Spanish moss [*Tillandsia usneoides*] during spring, the number surviving in hibernation cages and the number found in cotton fields during May and June, between the number of days with temperatures below 20°F. and the number of weevils found in hibernation cages and cotton, but not in Spanish moss, and between the minimum temperature for the winter and the number of weevils surviving in hibernation cages, the numbers found in Spanish moss and cotton fields being apparently affected to a certain extent [*cf. R.A.E.*, A **24** 332]. Records for 1936–40 showed that the number of weevils in trash from woods near cotton fields was more closely associated with the number found in cotton fields in May and June than the number surviving in hibernation cages or Spanish moss, and it is therefore concluded that Spanish moss affords less protection in winter than other shelters, particularly débris on the ground in woods [*cf.* **31** 188]. The number of weevils surviving in hibernation cages or Spanish moss and the number in the field in spring were not significantly correlated with the percentage increase in yield in experimental plots treated with calcium arsenate, the yield per planted acre and the total yield in the district, indicating that other factors have more influence on yield than the survival of overwintered weevils. The total rainfall from 21st June to 19th August was significantly correlated with the percentage increase in yield in the experimental plots, but not with yield per planted acre or total yield, and the number of days on which there was at least 0·3 in. rain with the percentage increase and the total yield, but not with the yield per planted acre [*cf.* **25** 236], indicating that summer rainfall has a much greater influence on percentage increase in yield in treated plots than on yield per acre or total yield. The percentage increase in yield in experimental plots was significantly correlated with yield per planted acre and total yield in the district.

Lilly (J. H.). **Combination Rotenone-Nicotine "Blends" for Pea Aphid Control.**—*J. econ. Ent.* **36** no. 1 pp. 85–97, 2 figs., 6 refs. Menasha, Wis., 1943.

In view of the variable results obtained with rotenone-bearing dusts in the control of *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) on peas in Wisconsin, investigations were carried out in 1941 and 1942 with rotenone-bearing dusts (chiefly cubé), nicotine dusts and blends containing rotenone-bearing materials and nicotine in proportionately reduced concentrations, applied under a trailer apron 50 ft. long. The tests were carried out in Wisconsin approximately throughout June and in Michigan throughout July, but the results obtained in Wisconsin, being less conclusive owing to weather and other factors, are not reported in detail. Aphid collections made in 1941 before treatment and two, three or four times afterwards showed that a dust containing 5·21 lb. cubé (5·4 per cent. rotenone) and 0·425 lb. nicotine alkaloid (at least 99 per cent. nicotine) in 24·36 lb. Pyrax ABB (pyrophyllite) with 10 lb. each of Curbay-X (a dried distillers molasses residuum product used as a hygroscopic conditioning agent) and dusting sulphur was slightly inferior to dusts containing 3·47 lb. cubé and 0·85 lb. nicotine alkaloid or 1·735 lb. cubé and 1·275 lb. nicotine alkaloid in 25·68 and 26·99 lb. pyrophyllite, respectively, with the same supplementary ingredients, but that all three were superior to unblended dusts. These comprised 5·56 lb. cubé in 34·04 lb. pyrophyllite with 0·4 lb. lubricating oil or in 18·04 lb. pyrophyllite with 0·4 lb. oil and 8 lb. each of Curbay-X and dusting sulphur, and Black Leaf 10 dust base (10 per cent. by weight of nicotine alkaloid on ground tobacco base) at a concentration of 17 lb. in 33 lb. hydrated lime or of 12 lb. in 32·5 lb. hydrated lime with 5 lb. Curbay-X and 0·5 lb. 93 per cent. Lorol thiocyanate. There was little difference in effectiveness between the four unblended dusts.

In 1942, investigations were made on the effect under adverse weather conditions and the deterioration in storage of blends containing approximately 0·375 per cent. rotenone and 1·7 per cent. nicotine, the importance of a hygroscopic agent and dusting sulphur as supplements and the value of certain new variations and combinations of toxic ingredients. The blended dusts gave better results than either rotenone or nicotine dusts at temperatures of 50–61°F., at wind velocities of 9 miles an hour or more and against very hardy Aphid populations. A sample of the complete blend recommended, consisting of 3·47 lb. cubé (5·4 per cent. rotenone) and 8·5 lb. Black Leaf 10 dust base in 28·03 lb. Pyrax ABB with 5 lb. each of dusting sulphur and Curbay-X, that had been mixed in December 1941, gave results comparable with the same dust freshly mixed, but the effectiveness was decreased by storage when either sulphur or the hygroscopic agent was omitted, and omission of both resulted in a comparatively poor dust after storage. Hygroscopic materials caused some caking in storage. When the dusts were used immediately after mixing the sulphur was not necessary, but the hygroscopic agent was of some value. Alkaloidal nicotines should be used in the blended dusts ; tests showed that 99 per cent. nicotine alkaloid and Black Leaf 10 dust base gave identical results provided that equal concentrations of nicotine were present in the finished dusts and these had essentially the same physical properties, but unreported experiments indicated that blends prepared with a fixed nicotine (Black Leaf 155) or a semi-fixed nicotine (Black Leaf 12 dust base) are inferior to similar formulae prepared with 99 per cent. nicotine alkaloid ; nicotine sulphate (Black Leaf 40) was used in certain formulae, but is not recommended as a substitute for the alkaloid in rotenone-nicotine blends. Hydrated lime and bentonite clays should not be used as diluents. Certain combination dusts containing reduced concentrations of ground cubé root (0·1, 0·25 and 0·4 per cent. rotenone) and 2, 3 and 2 per cent. Lethane 60 (an aliphatic thiocyanate) as toxic ingredients were comparable with 0·75 per cent. rotenone dust, but inferior to the blends of rotenone and nicotine. Others containing low concentrations of nicotine (1·7 per cent.), Lethane 60 (1 per cent.) and rotenone (0·187 per cent.) gave results comparable with those from the nicotine-rotenone combinations when used immediately after mixing, particularly when 10 per cent. each of dusting sulphur and a hygroscopic agent was included.

PHILLIPS (G. L.), EASTER (S. S.) & HORAIST jr. (G.). **Methyl Bromide Fumigation for Control of the Sweetpotato Weevil and its Effect on Yield.**—*J. econ. Ent.* **36** no. 1 pp. 98–101, 2 refs. Menasha, Wis., 1943.

The following is based on the authors' introduction and summary. Experiments on the use of methyl bromide to destroy *Cylas formicarius elegantulus*, Summers, in draws [spring shoots] and cuttings of sweet potato, instead of in tubers, were carried out in Louisiana and Alabama during 1938–41, as fumigation of the tubers involves the expense of subsequent heating [*R.A.E.*, A **29** 413], and draws may become infested in the seed-bed before being planted out. In 15 laboratory tests with 1,122 infested plants, methyl bromide at a dosage of 10 oz. per 1,000 cu. ft. for 4 hours at 80°F. gave a complete kill of all stages of the weevil. In 38 field tests with 177,749 draws and cuttings, dosages as high as 25 oz. per 1,000 cu. ft. for 4 hours at 80°F. or above caused no excessive mortality of the plants. From approximately 1,580,000 draws and cuttings fumigated and used for commercial plantings, satisfactory stands and yields were obtained.

It is evident, therefore, that a reasonably wide margin of safety exists between the dosage that will injure the plants and that required to destroy the weevil in them. A dosage of 16 oz. per 1,000 cu. ft. for 4 hours at 80°F. appears to be the most convenient schedule for commercial use.

SMITH (H. D.). **Laboratory Rearing of *Microbracon vestiticida* Vier. on the Bean Weevil, with Notes on the Life History of the Parasite.**—*J. econ. Ent.* **36** no. 1 pp. 101–104. Menasha, Wis., 1943.

In the autumn of 1941, two consignments of adults of *Microbracon vestiticida*, Vier., a parasite of *Anthonomus vestitus*, Boh., on cotton in Peru, were received in the United States for mass rearing and liberation against *A. grandis*, Boh., which the Braconid had previously been shown to attack. Attempts were made to rear it on *Ephestia kuehniella*, Zell., *Tribolium confusum*, Duv., *Calandra* (*Sitophilus*) *oryzae*, L., and *Bruchus* (*Acanthoscelides*) *obtectus*, Say, but only the last gave promising results, the pupae being most attractive, followed by the prepupae and larvae. Details are given of the methods of inducing parasite oviposition, rearing conditions and the rearing of the Bruchid host in beans. The parasites usually mated on the day of emergence, and oviposition began about 10–14 days later. The females deposited an average of one egg every two days; they had some difficulty in piercing the bean skin with their ovipositors, and various methods of overcoming this were tested, the most satisfactory being to place the infested beans in tubes of mosquito netting about four inches long, which were dipped in water and shaken out just before being put in the oviposition cages. In some cases the female fed on the body fluids of the host, first paralysing it with the ovipositor and then forming a feeding tube extending from the puncture in its body through the bean skin. The egg is deposited externally on the body of the host and hatches in about 24 hours at 70°F. The newly hatched larva crawls over the host, apparently to kill any other eggs or larvae present, and usually kills the host, if it is not paralysed, after about one day of feeding. The larval stage lasts 4–5 days and the life-cycle about two weeks at 70°F., and the females live 5–6 weeks in the laboratory at 70–75°F. The last complete generation in the experimental series yielded 9·6 progeny per female for the 100 females that were used. By using the Bruchid as an alternative host, it is possible to increase the parasite stock during the winter, when immature stages of *A. grandis* are not available, so that large releases can be made as soon as suitable stages occur in the field in early summer

RICHARDSON (H. H.), SCHECHTER (M. S.) & HALLER (H. L.). **Toxicity of some Nitroparaffins to the Confused Flour Beetle.**—*J. econ. Ent.* **36** no. 1 p. 111, 6 refs. Menasha, Wis., 1943.

The results are given of tests in 1939 and 1941 in which nitromethane and five readily available homologues of it were compared with carbon bisulphide as fumigants against *Tribolium confusum*, Duv. From 50 to 100 beetles were exposed to various concentrations near the minimum lethal dose for five hours at 25°C. [77°F.] and approximately 50 per cent. relative humidity, and final mortality counts were made 10–20 days after treatment. The approximate concentrations in mg. per litre to give 50 and 95 per cent. mortality, as determined from curves, were 8 and 10 for 1-nitrobutane, 9 and 14 for nitroethane, 11 and 16 for 1-nitropropane, 13 and 20 for 2-nitrobutane, 19 and 35 for 2-nitropropane, 37 and 55 for nitromethane, and 56 and 100 for carbon bisulphide, respectively ; 1-nitrobutane is much less volatile than methyl bromide, and 2-nitropropane and 2-nitrobutane were more volatile than their isomers. Studies of a possible post-fumigation effect showed little change in mortality between 4 and 20 days after treatment.

ROARK (R. C.). **Volatile Fluorine Compounds as Insecticides.**—*J. econ. Ent.* **36** no. 1 pp. 111–112, 3 refs. Menasha, Wis., 1943.

The author points out that the fluorine compounds used as fumigants against insects by Marcovitch [*R.A.E.*, A **31** 21] have physical and chemical properties and a toxic action on man that preclude their practical use. Hydrofluoric acid is highly corrosive and would leave a fluorine residue on grain much greater than that permitted on sprayed fruits if it were used at the minimum dosage necessary to kill weevils ; hydrofluosilicic acid is not sufficiently volatile to serve as a fumigant ; and silicon tetrafluoride and boron trifluoride are converted into hydrofluosilicic acid and fluoboric acid, respectively, in the presence of water and could be used only in anhydrous conditions in which the insects would die in any case. He lists other volatile inorganic fluorine compounds that might be even more toxic to insects, but are too poisonous to man to be recommended as fumigants, and suggests that only organic compounds, such as fluoroform and possibly the esters of fluoroacetic acid, are likely to be of practical use.

DELONG (D. M.) & MCCALL (G. L.). **A Combination of 2, 4-dinitro-6-cyclohexylphenol with Sulphur as a Substitute for Pyrethrum for Control of Potato Leafhopper.**—*J. econ. Ent.* **36** no. 1 pp. 112–113, 4 refs. Menasha, Wis., 1943.

In laboratory and large-scale field experiments carried out in Ohio in 1941–42 to develop a dust of available materials that would control *Empoasca fabae*, Harr., and also act as a fungicide, dusts containing 50 per cent. sulphur in an inert diluent (volcanic ash) with 1 per cent. dinitro-ortho-cyclohexylphenol or sufficient of its dicyclohexylamine salt to give 1 per cent. of the phenol, applied at the rate of 20–45 lb. per acre, gave satisfactory control of the Jassid on lucerne, potato and beans and caused no foliage injury.

MILLER (L. I.). **A White Grub injuring Peanuts in eastern Virginia.**—*J. econ. Ent.* **36** no. 1 pp. 113–114, 1 fig. Menasha, Wis., 1943.

A new type of damage to ground-nuts, observed in eastern Virginia in the autumns of 1938–41, was found to be caused by larvae of the Rutelid, *Strigoderma arboricola*, F., which attacked immature pods by cutting circular holes in the shells and devouring the kernels and mature ones by forming lesions on the surface of the shell through which soil fungi (*Rhizoctonia*) were able to penetrate. It was found that many of the large plants with numerous blossoms that failed to produce nuts had been stripped by the larvae of all underground parts except the main root. Ground-nuts growing in dark soils high in organic matter, where the plants had made heavy growth, were more commonly attacked than those growing in light soils, which had made poor growth, and the number of grubs and amount of injury was greater in low areas and in water furrows. The grubs cause a loss of 85 per cent. in some fields. Adults of *Strigoderma* are common in eastern Virginia from about 15th May to 10th June, when they cause great damage to the blossoms of roses and other ornamental plants and are common on the foliage and flowers of ground-nuts. Injury to ground-nuts by *S. arboricola* was found in each of the seven eastern counties, in which 90 per cent. of the ground-nuts grown in the State are produced, but is apparently greatest in the southern part of the belt.

WENE (G.) & DOMINICK (C. B.). **The Abundance of** *Microctonus epitricis* **(Vier.) in Virginia.**—*J. econ. Ent.* **36** no. 1 pp. 114–115, 1 ref. Menasha, Wis., 1943.

The percentage parasitism by *Microctonus epitricis*, Vier. [*cf. R.A.E.*, A **30** 187] of adults of the tobacco flea-beetle [*Epitrix parvula*, F.] collected under leaves and on potato in spring and on tobacco in summer near Chatham, Pittsylvania County, ranged from 3·2 to 16·6 in different months in 1941 and from 0·04 to 13·3 in 1942. The percentage parasitism in collections made in July–September 1941 in the other tobacco-producing counties of Virginia varied from 3·4 to 17·8 ; the Braconid was found in every county in which collections were made. The figures and dates of collection in the various localities are shown in tables, and the way in which the material was handled is briefly described.

WILCOX (J.) & GOWLAND (A. F.). **Damage to Strawberry Fruit by Small Darkling Beetles** (*Blapstinus* **spp.**).—*J. econ. Ent.* **36** no. 1 p. 116, 1 fig., 3 refs. Menasha, Wis., 1943.

Beetles of the genus *Blapstinus* were found damaging the fruits of strawberry in California in February 1942 ; shallow round or irregular holes had been made in about 50 per cent. of the fruits in one field by 12th February. A bait of 20 lb. bran, 1 lb. Paris green, 1 U.S. quart molasses and enough water to make a crumbly mash, applied along the rows to the entire field (40 acres) at the rate of about 5 lb. per acre between 15th and 18th February, killed about 50 per cent. of the beetles and reduced their numbers from 1·1 to 0·5 per plant by 19th February, when fruit damage had fallen to about 10 per cent.

PECHUMAN (L. L.). *Epitrimerus pyri* **Nal. in New York.**—*J. econ. Ent.* **36** no. 1 p. 116. Menasha, Wis., 1943.

Russeting observed on normally smooth-skinned pears in western New York in 1942 was found to be caused by the mite, *Epitrimerus pyri*, Nal., with which both leaves and fruit were covered. It was identified by H. H. Keifer, who believes that it has the same type of deuterogynous development as the western form, *E. pirifoliae*, Keifer [*cf. R.A.E.*, A **31** 208]. Injury first became noticeable in early July and was severe in many orchards by the end of the month; it was confined largely to pears on the outside of the trees and to terminal growth. The population declined during August, and few mites were present at harvest in late August and early September. Summer oil (1·5 per cent.) gave excellent control when applied from the ground so that the fruit and lower surface of the leaves were well covered. It is suggested that the large population of *E. pyri* may have been due to the omission of the summer-oil sprays usually applied against the pear psylla [*Psylla pyricola*, Först.], which was not numerous in 1942.

Cotton (R. T.) & Young (H. D.). **Acrylonitrile and Trichloroacetonitrile in Admixture with Carbon Tetrachloride as possible Fumigants for stored Grain.**—*J. econ. Ent.* **36** no. 1 pp. 116–117, 2 refs. Menasha, Wis., 1943.

In tests in which batches of 150 insects in 20-litre glass bottles were fumigated with 99·5 per cent. acrylonitrile for 24 hours at 72°F., complete mortality of *Calandra* (*Sitophilus*) *oryzae*, L., and *Tribolium confusum*, Duv., was obtained with dosages of 1·6 and 5 mg. per litre, respectively; when half a bushel of wheat was put into the bottles, the dosages for complete mortality were 8 and 16 mg. per litre (0·7 and 1·4 lb. per 1,000 bushels wheat). When wheat was present, a given quantity of a mixture of equal volumes of acrylonitrile and carbon tetrachloride, which eliminates danger from fire and presumably assists the distribution of the fumigant by increasing its volume, was apparently as effective as the same quantity of acrylonitrile used alone. Preliminary milling and baking tests indicated that if treated grain is milled without aeration, the milling quality is somewhat adversely affected but the baking quality improved; the adsorbed fumigant apparently largely disappears with aeration.

Similar fumigation tests with a mixture of 97 per cent. trichloroacetonitrile and carbon tetrachloride (1 : 19 by volume) showed that the minimum lethal dosage of the mixture to *C. oryzae* was 47 mg. per litre (2 mg. trichloroacetonitrile per litre) without wheat and 396 mg. per litre with wheat (35 lb. mixture or 1·5 lb. trichloroacetonitrile per 1,000 bushels wheat). The minimum lethal dosage of the mixture for *T. confusum* in the presence of wheat was 95 mg. per litre (8·4 lb. mixture or 0·38 lb. trichloroacetonitrile per 1,000 bushels wheat).

The physical constants of the two nitriles are given, and data on their toxicity to mammals are briefly reviewed.

Steiner (L. F.) & Arnold (C. H.). **Influence of Changes in Relative Humidity on the Effect of certain Insecticides on newly hatched Codling Moth Larvae.**—*J. econ. Ent.* **36** no. 1 pp. 117–118. Menasha, Wis., 1943.

Newly hatched larvae of the codling moth [*Cydia pomonella*, L.] were placed on apples that had been subjected to 12 days of weathering on the trees, including 1·28 in. rainfall, after the eighth and final cover spray and on others from unsprayed trees between 26th and 28th August, and equal numbers were kept in the laboratory at a constant temperature of 81°F. and relative humidity of 74 per cent. and in the insectary under different conditions of temperature and humidity. The efficiencies of the sprays were determined by comparing the percentage of successful entrances in sprayed and corresponding unsprayed apples after eight days. The efficiencies of two sprays of lead arsenate, copper sulphate and lime (3, 0·75 and 1·5 lb. and 4, 4 and 8 lb. per 100 U.S. gals.), one of micronised phenothiazine (2·7 lb. per 100 U.S. gals.) and two of tank-mix nicotine bentonite (0·66 U.S. pint nicotine sulphate, 3·3 lb. Wyoming bentonite and 1 U.S. quart crude soy-bean oil per 100 U.S. gals. with or without the addition of 6 oz. copper phosphate) on apples kept at temperatures of 63–73·5 and 73·5–84°F. and at humidities of 59–62 and 71–80 per cent. and on corresponding apples in the laboratory are tabulated. The weaker lead-arsenate spray showed no significant difference in effectiveness at different temperatures and humidities, but the toxicity of the stronger one increased at higher humidities and at lower temperatures and that of the phenothiazine and both the nicotine-bentonite sprays decreased as the humidity was lowered.

HARRINGTON (C. D.). **The Occurrence of physiological Races of the Pea Aphid.**—*J. econ. Ent.* **36** no. 1 pp. 118–119. Menasha, Wis., 1943.

To determine whether physiological races of *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.) occur in the United States, nine pure lines from Aphids collected in eight widely separated States were bred during the winter of 1941–42 and tested for size and fecundity in spring. Both the body length and width of 50 adults of uniform age from each line and the numbers of progeny that uniformly aged Aphids of each line produced on three varieties of peas in a given time under similar temperature conditions showed negligible variation within lines but highly significant differences between lines, high fecundity being correlated with added size, and it is concluded that at least four physiological races, differing significantly in both size and fecundity, are present in the United States.

PECHUMAN (L. L.). *Scolytus sulcatus* **Lec. in western New York.**—*J. econ. Ent.* **36** no. 1 p. 119, 1 ref. Menasha, Wis., 1943.

Wilting and browning of the leaves on the leaf and fruit spurs of sweet cherry in an orchard in western New York in June 1940 was found to be due to injury at the base of the spur, which was sometimes completely cut through ; in most of the wounds an adult of *Scolytus sulcatus*, Lec., was feeding in the crotch between the spur and the twig. A wood pile at the edge of the orchard, where large numbers of this Scolytid were emerging from apple, sweet cherry and plum wood, was found to be the source of infestation. There was little injury more than 100 yards from the wood pile, but within that distance some trees had nearly every fruit spur destroyed. A few apple and sour cherry trees were attacked, but sweet cherries appeared to be preferred. The beetles were also attempting to enter the trunks and larger branches of the sweet cherries, but this was prevented by the copious flow of sap. Within two weeks, all the leaves on the damaged spurs had turned brown.

In 1941 and 1942, a few other less serious attacks were observed in western New York ; in all cases infestation could be traced to wood piles.

BARNES (D. F.). **Influence of Moth-trapping Methods on the Proportion of Females in the Catches.**—*J. econ. Ent.* **36** no. 1 pp. 119–120, 1 ref. Menasha, Wis., 1943.

Females represented 46 per cent. of 67,096 adults of *Ephestia figulilella*, Gregson, caught in vineyards and fig orchards in the San Joaquin Valley in bait traps containing malt syrup, yeast and water during seven flight seasons, 31 per cent. of 36,383 taken in a rotating net that was operated continuously in a fig orchard in 1937 and a raisin storehouse in 1938 and 1939 [*cf. R.A.E.*, A **28** 481] and 49 per cent. of 2,079 reared from larvae collected in vineyards, orchards and raisin storehouses. The percentages of females among 13,194 adults of *Desmia funeralis*, Hb., caught in the bait traps, 837 taken in a rotating net on the night of 15th–16th August 1941 and 846 reared from larvae collected in vineyards, were 60, 34 and 50. The sex ratios obtained from the rearings are considered to be reliable as controls, owing to the random nature of the sampling. The higher proportion of males taken in rotating nets is probably due to the longer period during which they fly at night. Examination of catches at 15-minute intervals showed that with both species flight began about 45 minutes after sunset and continued all night, females predominating in the first two or three hours, when activity was greatest, and males during the rest of the night. The difference in sex ratios between reared material and that taken in bait traps has not been satisfactorily explained.

CLARK (C. A.) & CARTER (S. W.). **The Collection, Rearing, and Release of Parasites of the European Corn Borer in 1942.**—*J. econ. Ent.* **36** no. 1 p. 120. Menasha, Wis., 1943.

To furnish parasites for release in 1942, 14,214 overwintering larvae of the European corn borer [*Pyrausta nubilalis*, Hb.] were collected in central Connecticut and 3,735 in south-eastern Massachusetts in the autumn of 1941, as several of the imported parasites [*cf. R.A.E.*, A **31** 288] are well established in these areas. The larvae were kept at 35°F. and approximately 70 per cent. relative humidity and supplied with contact water until 1st June, after which the temperature was gradually raised to 80°. Approximately 15,000 parasites of four imported species emerged and of these, about 75 per cent. were *Macrocentrus gifuensis*, Ashm., from borers collected in Massachusetts; the others comprised *Angitia* (*Inareolata*) *punctoria*, Roman, *Lydella grisescens*, R.-D. [the Tachinid also known as *Ceromasia senilis*, Mg.], and *Chelonus annulipes*, Wesm. Because of the small numbers available, *Chelonus* was released only in New Jersey and the Tachinid only in Wisconsin; the other two species were released in both these States and also in Illinois, Indiana and Pennsylvania. All releases, with the possible exception of those in Wisconsin, were made under favourable conditions.

TATE (H. D.). **The Occurrence of the Potato Tuber Worm in Nebraska.**—*J. econ. Ent.* **36** no. 1 pp. 120–121, 1 ref. Menasha, Wis., 1943.

Larvae of *Gnorimoschema operculella*, Zell., were found in numbers in a large bin of potatoes on a farm in Cass County, Nebraska, in September 1939, but there was no evidence of infestation in potato fields in the vicinity in 1940. Small numbers of larvae were collected in August in growing plants and later in tubers left in the field in Lancaster County in 1940, but no injury was found in the same areas in the following year. The seed potatoes for these fields were apparently obtained from outside the State. A survey of the State in 1942, in the course of which 100–300 plants in each of about 75 different fields, more than half of which were in the seed-producing area of western Nebraska, and large numbers of other solanaceous plants were examined, revealed infestation in small numbers of potato plants in four localities in the counties of Lancaster, Lincoln (one individual), Buffalo and Box Butte (two individuals). In eastern and central Nebraska, both seed and table potatoes are mostly obtained from outside the State, but in western Nebraska, seed potatoes are almost entirely of local origin and table stock is largely home-grown, though there is sufficient importation of the latter to account for the isolated infestation found there. These records suggest that infestations have resulted from seasonal importations.

LINSLEY (E. G.). **The Dried Fruit Moth breeding in Nests of the Mountain Carpenter Bee in California.**—*J. econ. Ent.* **36** no. 1 pp. 122–123, 4 refs. Menasha, Wis., 1943.

Vitula serratilineella, Rag., which has infested dried fruit in the San Joaquin and Santa Clara valleys of California [*cf. R.A.E.*, A **16** 268], was found breeding in the cells of *Xylocopa orpifex*, Smith, in an old log of *Libocedrus decurrens* in California in June 1942. The same series of cells was infested with

Aphanotus brevicornis, Lec., and species of *Attagenus* and *Trogoderma*, and it was therefore impossible to determine with certainty what the larvae of the moths were feeding on, though the indications were that they had fed on pollen.

Barber (G. W.). **Injury to Leaves of Sweet Corn by the Leafhopper** *Dikraneura carneola* **(Stål).**—*J. econ. Ent.* **36** no. 1 p. 123, 1 fig. Menasha, Wis., 1943.

The Jassid, *Dikraneura carneola*, Stål, attacked sweet maize grown for seed in Canyon County, Idaho, in 1942. It was first observed in a field bordering the desert on 16th July, when only adults were present. Their occurrence in large numbers at one edge of the field indicated that they had recently migrated to it, probably in a massed flight, since daily observations before 16th July had revealed no leafhoppers. They had become generally distributed through the field a week later, were observed in other fields of seed sweet maize in the neighbourhood as the season advanced, and remained until the end of September. The injury comprised conspicuous light irregular blotches, which were common on the leaves of small plants and the lower leaves of large plants. Damage to the smaller plants probably caused a reduction in the yield of seed.

Essig (E. O.). **The Cork Oak Cynipid in California.**—*J. econ. Ent.* **36** no. 1 pp. 123–124, 3 refs. Menasha, Wis., 1943.

A survey of cork oaks [*Quercus ilex* var. *suber*] in California, carried out in view of the scarcity of cork importations during the last few years, showed that *Plagiotrochus suberi*, Weld, is injurious to these trees in many districts [*cf. R.A.E.*, A **17** 35]. This Cynipid makes galls within the tissues just beneath the bark of the smaller twigs and sometimes kills many of them and reduces the production of cork. It occurs throughout much of the State, but is most abundant in the south. Nearly all the older trees are infested to some extent, even though wholly isolated, but young trees are relatively free from attack and some appear to be more or less immune for at least 10–15 years. Control measures consist in cutting out and burning the infested twigs and giving the trees good care to ensure vigorous new growth.

Baker (E. W.). **Survival Periods for Eggs of** *Anastrepha ludens* **(Loew) during Vapor-heat Sterilization.**—*J. econ. Ent.* **36** no. 1 p. 124, 2 refs. Menasha, Wis., 1943.

In investigations in 1941 and 1942 to confirm the view that the eggs of *Anastrepha ludens*, Lw., are less resistant than the larvae to vapour-heat sterilisation of fruit [*cf. R.A.E.*, A **20** 571 ; **26** 751], eggs obtained by allowing the flies to oviposit through hollowed-out sections of mango skin, the under sides of which had been washed with cupric chloride solution to prevent the growth of fungi, were placed in a sterilisation cabinet in which the temperature was raised from 20·3°C. [68·54°F.] to 43·3°C. [109·94°F.] in eight hours and maintained at that level for six hours, batches of 209–500 being removed at hourly intervals from the end of the third hour. More than 70 per cent. hatched after three and four hours, when the temperatures were 36·9°C. [98·42°F.] and 39·6°C. [103·28°F.], respectively, more than 60 per cent. after five hours, when the temperature was 41·3°C. [106·34°F.], and 16·5–32·7 per cent. after six hours, when it was 42·2°C. [107·96°F.]. After seven and eight hours, when the temperature had reached 42·6°C. [108·68°F.] and 43·3°C., 9·8 and 0·4 per cent. hatched in 1941, but none hatched after seven hours in 1942. There was no sign of larval development in the eggs removed during the six hours of the exposure period. Since larvae in fruit have survived the first three hours of this period and similar results have been obtained with naked larvae, any vapour-heat treatment that will kill the larvae will also kill the eggs.

Young (H. D.) & Cotton (R. T.). **Some Fumigants of the Nitroparaffin Group.**—*J. econ. Ent.* **36** no. 1 p. 125, 2 refs. Menasha, Wis., 1943.

In laboratory tests to compare the effectiveness of other nitroparaffins as grain fumigants with that of 1, 1-dichloro-1-nitroethane [*cf. R.A.E.*, A **30** 192], 0·6 cc. dichloro-nitroethane, 5 cc. nitroethane, 7 cc. 2-nitropropane and 8 cc. 1-nitropropane gave complete mortality of adults of *Calandra* (*Sitophilus*) *oryzae*, L., when the weevils were exposed for 24 hours in 20-litre bottles containing half a bushel wheat at about 75°F., but nitromethane failed to do so at 18 cc. Concentrations in air of 0·1 per cent. by volume of nitromethane, which has the lowest molecular weight of these compounds, are considered to be dangerous to man, and their toxicity appears to increase with their molecular weight. Baking and milling tests of wheat treated with dichloro-nitroethane indicated that its only noticeable effect on the baking characteristics was a reduction in the fermentation tolerance.

Quayle (H. J.) & Lindgren (D. L.). **A Gas-tight Fabric for Fumigation Purposes.**—*J. econ. Ent.* **36** no. 1 p. 125. Menasha, Wis., 1943.

Samples of a synthetic product (Koroseal) that were received in January 1941 and exposed to the weather on the sun roof of a building in California for six months showed no deterioration, and a 40-ft. fumigation tent of the same material has been used for two fumigating seasons in California and is still satisfactory, a reduction of two-thirds of the fumigant (hydrocyanic acid gas) giving a kill of the California red scale [*Aonidiella aurantii*, Mask.] on *Citrus* equal to that of the full dosage under an 8-ounce U.S. Army duck tent. Tests have shown that the material is very resistant to the attacks of mildew, and exposure to the sun in southern California for a year has affected it but little.

Back (E. A.) & Cotton (R. T.). **Industrial Fumigation against Insects.**—*Circ. U.S. Dep. Agric.* no. 369 (revd.), 63 pp., 38 figs., 13 refs. Washington, D.C., 1942.

In addition to the information given in the earlier edition [*cf. R.A.E.*, A **24** 294], this circular includes sections on large-scale fumigation in mills and warehouses with methyl bromide, a note on fumigation in vacuum chambers, atmospheric vaults and tight storage rooms with a mixture of methyl bromide and carbon dioxide, a more detailed account of the treatment of individual machines in mills with chloropicrin or hydrocyanic acid gas, and brief instructions on the fumigation of rice [*cf.* **31** 273] and cottonseed meal and the vacuum fumigation of flour products.

Bobb (M. L.). **Parasites of the Oriental Fruit Moth and of certain Weed-infesting Larvae.**—*Tech. Bull. Virginia agric. Exp. Sta.* no. 79, 23 pp., 9 figs., 11 refs. Blacksburg, Va., 1942.

As parasitism of larvae of *Cydia* (*Grapholitha*) *molesta*, Busck, is much higher in twigs than in fruit and few of the larvae develop in twigs towards the end of the season, the presence of alternative hosts for the parasites at that time is important. The parasitism of possible alternative hosts that attack weeds was accordingly investigated in peach-growing areas in six counties of Virginia in 1934–41. The literature on alternative hosts of parasites of *C. molesta* is briefly reviewed.

During 1931–37, eight parasites from abroad and two from other parts of the United States were liberated in these counties. They are *Perisierola angulata*, Mues., *Gambrus stokesi*, Cam., *Angitia* (*Inareolata*) *molestae*, Uch., *Microdus* (*Bassus*) *diversus*, Mues., *Macrocentrus thoracicus*, Nees, *Phanerotoma grapholithae*, Mues., *Orgilus longiceps*, Mues., *Phaeogenes haeussleri*, Uch., *M. ancylivorus*, Rohw., and *Glypta rufiscutellaris*, Cress., and the localities and years in which they were released are shown in a table. In surveys made in 1940–41, *M. ancylivorus* appeared to be the most important species attacking twig-infesting larvae in four counties, and *G. rufiscutellaris* and *M. delicatus*, Cress., were outstanding in the other two, respectively. These three parasites were the most widely distributed, occurring in 10 of the 11 localities where twig collections were made, and represented 83·3, 8·56 and 5 per cent., respectively, of the 20 species of parasites reared during 1934–41; averages of 65·5, 63·8 and 56·5 per cent., respectively, of the total number obtained of each in 1938–41 were females. The only other introduced parasite that was recovered was *A. molestae*. The percentages of parasitism by all species and by *M. ancylivorus* alone among twig-infesting larvae of each of the three generations in one county during 1934–41 are shown in a table; the averages were 17·46, 44·61 and 83·04 for all species and 16·82, 42·12 and 81 for *M. ancylivorus*. Observations during 1938–41 indicated that injury to the fruit was likely to be slight when small moth populations, as determined by bait-traps, were followed by 20 per cent. parasitism of second-generation larvae and when moderate populations were followed by 60 per cent. parasitism. The larvae appear to be attacked by parasites during the first week after hatching. The only parasites reared from many thousands of pupae exposed in orchards from 1937 onwards were two examples of *Hemiteles tenellus*, Say, and one of *Pimpla* (*Ephialtes*) *aequalis*, Prov., in 1940.

The possible alternative hosts from which parasites were reared were overwintering and summer-generation larvae of *Eucosma* (*Epiblema*) *strenuana*, Wlk., on ragweed (*Ambrosia artemisifolia*), and overwintering larvae of *E.* (*E.*) *otiosana*, Clem., on *Bidens* and cocklebur (*Xanthium canadense*). Of the parasites of *C. molesta*, *M. ancylivorus*, *M. delicatus*, *M. pallisteri*, DeGant, *G. rufiscutellaris*, *Lixophaga variabilis*, Coq., *Pristomerus ocellatus*, Cushm., and *Campoplex* sp. were bred from *E. strenuana* and *E. otiosana*, and *Cremastus epagoges*, Cushm., and *Pimpla aequalis* from *E. strenuana*. The most important of these on *E. strenuana* were *G. rufiscutellaris*, *Pristomerus ocellatus*, *Cremastus epagoges* and *M. delicatus*. *P. ocellatus* and *C. epagoges* emerged during the emergence period of *Cydia molesta*, and *M. delicatus* during that of *E. strenuana* (the second half of June and July). *G. rufiscutellaris* emerged long before larvae of either host were available, but about half of the adults kept in feeding cages in the insectary survived until that time. The larvae of *E. otiosana* feed on several species of *Bidens*, which are sometimes the most numerous weeds in peach orchards, and larvae reared from *B. bipinnata* and *B. frondosa* were heavily parasitised, the same parasites being reared from both. Larvae were less numerous on cocklebur, but the degree of parasitism was very high. Of the three parasites that were in general reared most frequently from *E. otiosana*, *M. pallisteri* was the only one that also attacked *C. molesta*, but only one example of it was obtained from the latter. In one county, *G. rufiscutellaris* comprised 9 of 16 parasites reared from *E. otiosana* on *B. bipinnata*, and this species was moderately abundant in most counties, though in some years it was not represented in all. *M. ancylivorus* was reared in small numbers in 1938, 1939 and 1941 from *E. strenuana* and in 1939 from *E. otiosana*. Only one individual of *M. delicatus* was reared from *E. otiosana*, but it was more common in *E. strenuana* and was responsible for 60 per cent. of the total parasitism among summer-generation larvae in one county in 1937 and for 50 per cent. of that among the overwintering larvae in 1938.

In studies in three orchards during 1938–41, the percentage of larvae of *C. molesta* that were parasitised was considerably higher for the first generation when weeds were allowed to remain in the orchard until early summer, somewhat higher for the second generation, and not appreciably affected for the third.

Hamilton (D. W.). **Recent Tests with some of the newer Insecticides for Codling Moth Control.**—*Proc. N.Y. St. hort. Soc.* **88** pp. 152–158. Le Roy, N.Y., 1943.

In experiments with substitutes for arsenicals in cover sprays against *Cydia* (*Carpocapsa*) *pomonella*, L., on apple, carried out in New York in 1941, four sprays were applied during entry of the first generation and two during entry of the second. Lead arsenate was used at the rate of 3 lb. with 3 lb. lime and 4 oz. powdered skim-milk per 100 U.S. gals.; the quantities given for the other materials are also the rates per 100 U.S. gals. water. The percentage of uninjured apples and (in brackets) the number of superficial injuries per 100 apples were 60·8 (11·7) for unsprayed trees and 94·6 (6) after six sprays of lead arsenate. After three cover sprays of lead arsenate, the corresponding figures were 89·6 (10·7) for three of 3 lb. nicotine bentonite (14 per cent. fixed nicotine), and 90 (10) for three of 1½ lb. nicotine bentonite with 2 U.S. quarts summer oil. After one spray of lead arsenate, they were 92·9 (5·8) and 93·7 (5·1) for five of 1½ lb. nicotine bentonite with 2 U.S. quarts oil and with 1 lb. sodium oleate, respectively, 93·2 (5·8) for 2 lb. xanthone (particle size 10 microns) with a commercial adhesive and 1 U.S. quart kerosene, and 97·3 (3·2) for 1 lb. xanthone and 2 lb. lead arsenate with 3 lb. lime and 4 oz. powdered skim-milk in the second and fourth sprays and 2 lb. xanthone with the kerosene and adhesive in the third, fifth and sixth. They were 88·3 (11·6) and 93·4 (5·7) after lead arsenate in the first, second and fourth sprays and 2 lb. xanthone or micronised xanthone (2 microns) with kerosene and adhesive in the others; 92·9 (5·7), 97·4 (1·9) and 98·8 (1·2) after two sprays of lead arsenate followed by four of 2 lb. regular, milled or micronised phenothiazine (average particle size 9·5, 6·8 and 2·5 microns, respectively); and 92·2 (8·5) after three of lead arsenate followed by three of micronised phenothiazine.

Of these treatments, 1½ lb. nicotine bentonite with oil left less visible residue than 3 lb. alone, and 1½ lb. with sodium oleate left none. Nicotine sprays seem to be relatively ineffective against *Rhagoletis pomonella*, Walsh. Xanthone usually causes russetting, which is severe if it is used throughout the growing season, but not sufficient to cause commercial injury when it is not used until the third cover spray. It left an objectionable white residue on the fruit at harvest, which was increased when it was micronised, and is relatively ineffective against *R. pomonella*. Phenothiazine was as effective as lead arsenate against *R. pomonella*, but all spreaders and adhesives tested in combination with it tended to reduce its toxicity, and it left a greyish green residue that was often so dense as to affect the colour of the apples.

Hammer (O. H.). **Some Facts and Observations regarding Summer Control of Red Mite.**—*Proc. N.Y. St. hort. Soc.* **88** pp. 174–180. Le Roy, N.Y., 1943.

The author describes the life-history of the European red mite [*Paratetranychus pilosus*, C. & F.] on apple in New York, the nature of the injury it causes and methods of controlling it [*cf. R.A.E.*, A **31** 3]. The dicyclohexylamine salt of dinitro-o-cyclohexylphenol, applied thoroughly as a foliage spray or dust, kills many of the eggs and practically all the later stages in 3–4 days, though the immediate mortality is not particularly high; when it is used as a spray, many of the mites from treated eggs die during hatching or immediately after. One thorough application usually gives protection for a month or more, but under adverse conditions, a second application 7–10 days after the first may be desirable. The salt may be used with lead arsenate and the milder forms of sulphur at normal temperatures during the early post-bloom period, but if temperatures of 80°F. or more occur within 48 hours of its application in a spray with sulphur or just before or after a sulphur treatment, some injury to the trees may result. Spray lime, lime-sulphur, Bordeaux mixture and other strongly alkaline materials should not be used with it as they largely destroy its toxicity, and oil should not be used in sprays containing quantities of dinitro compounds that are toxic to the mite on apple trees. The leaves of the most susceptible varieties should be inspected once a week from about 12–14 days after petal fall, and control measures should be applied if an average of 2–4 mites per leaf is found in June or early July or of 5–8 in late July and August.

SHULL (A. F.). **Origin of diverse Strains of an Aphid Species within a limited Area.**—*Pap. Mich. Acad. Sci.* **28** (1942) pp. 425–431, 2 refs. Ann Arbor, Mich., 1943.

Two strains of *Macrosiphum solanifolii*, Ashm., collected in southern Michigan in 1923 and 1931 reacted to light in the same way, in that most individuals had wings if the late prenatal stages were passed in intermittent light, but were wingless if those stages were subjected to continuous light. This tendency was maintained for six and eight years, respectively, and was then reversed, more winged individuals being produced in continuous than in intermittent light. The 1923 strain was kept for nearly ten years longer, but its behaviour underwent no further material change. Of five strains collected in the same locality in 1939 and tested in the autumn, four produced no winged examples in continuous light. Two of these produced many more winged than wingless Aphids in intermittent light, and the other two produced slightly more. The fifth strain produced almost as many winged as wingless individuals in continuous light and a few winged ones in intermittent. The ways in which the diverse strains could have originated in a single locality are discussed.

PERSING (C. O.), BOYCE (A. M.) & BARNHART (C. S.). **Present Status of Citrus Thrips Control.**—*Calif. Citrogr.* **28** no. 6 pp. 142, 165, 1 fig. Los Angeles, Calif., 1943.

This is a progress report on investigations begun in 1942 on the extent of the areas in which resistance to sprays of tartar emetic has developed in the citrus thrips [*Scirtothrips citri*, Moult.] and on methods of control in these areas [*cf.* *R.A.E.*, A **31** 209]. Tests in which adults collected on lemon in the principal infested areas in southern California and on orange in two districts in central California were caged on leaves that had been sprayed so as to leave a deposit of 2·5 mmg. each of tartar emetic and sugar per sq. cm. and examined for mortality 48 hours later showed that resistant thrips occurred in some of the groves in the central districts and also in the San Fernando Valley, but none was found in other districts south of the Tehachapi mountains. Of thrips from different groves in the San Fernando Valley, from 0 to 68·3 per cent. survived the test, and some degree of resistance, indicated by survivals greater than 4·4 per cent., was found over about 1,500 acres of lemons. The occurrence of resistance does not appear to be correlated with the number of treatments with tartar emetic that have been received, and it is not yet possible to predict the future spread of resistance with any accuracy. The use of tartar emetic at concentrations already noticed [*cf.* **31** 58] should be continued in groves in which it has given satisfactory control in the previous season. In districts where tartar emetic is not effective, a spray of nicotine sulphate and sugar may be of value on lemons [**31** 209]; oranges should be treated with sulphur dust or lime-sulphur spray in spring, and with the nicotine spray in late summer if it is desirable to reduce foliage scarring.

Greenhouse Thrips on Oranges in coastal Districts.—*Calif. Citrogr.* **28** no. 6 p. 162, 1 fig. Los Angeles, Calif., 1943.

Since the summer of 1941, the greenhouse thrips [*Heliothrips haemorrhoidalis*, Bch.] has spread rapidly on Valencia oranges in the coastal areas of California [*cf. R.A.E.*, A **30** 430, etc.]. Fruit in the interior of the trees, and particularly off-bloom fruit, is chiefly attacked, and the thrips population reaches its maximum in late summer. The addition to the late summer oil spray of ¼ pint pyrethrum extract per 100 gals., with calcium caseinate spreader, followed two weeks or more later by a spray containing ¾ pint extract per 100 gals. with spreader against the thrips that hatch after the first application, has given the most satisfactory control [*cf.* **31** 58]. Nicotine sulphate used in the same way is almost as effective. Off-bloom fruits should be removed before spraying is attempted, and clusters of fruit should be thinned during the first pick in April or May, before much marking has taken place.

Clarke (J. F. G.). **A new Pest of *Albizzia* in the District of Columbia (Lepidoptera: Glyphipterygidae).**—*Proc. U.S. nat. Mus.* **93** no. 3162 pp. 205–208, 5 pls. Washington, D.C., 1943.

Descriptions are given of the adults, larva and pupa of *Homadaula albizziae*, sp. n., a moth that has been probably introduced from the Indo-Australian region; the larvae were found attacking the flowers and foliage of *Albizzia julibrissin* in the north-western part of the District of Columbia in 1940 and later in adjacent districts in Maryland, where they became more abundant in 1942. There was no evidence of the presence of the moth in Virginia.

The life-cycle lasts 22 days in summer, and there appear to be two or more complete generations a year. The eggs are laid on the flowers, which are preferred, or on the leaves, and the larvae at first live gregariously under a web. Later they migrate to different parts of the tree and web the leaves together in large conspicuous masses. When fully fed, they drop to the ground and spin cocoons in sheltered positions. Winter is passed in the pupal stage.

Miller (R. L.). **War and its Effect on the Insecticide Industry.**—*Florida Ent.* **25** no. 4 pp. 53–56, **26** no. 1 pp. 8–11. Gainesville, Fla., 1943.

The author quotes a list showing the quantities of the major chemicals used annually as insecticides and fungicides in the United States [*R.A.E.*, A **31** 167] and points out that, owing to the war, the supplies of these are likely to be uncertain and their transport difficult. He gives notes on the value and available supplies of those commonly used, recommends that reduced dosages should be applied where possible and equipment carefully preserved, and suggests that entomologists could assist growers to obtain economical control by calling their attention to incipient stages of insect outbreaks.

Tissot (A. N.). **The Mexican Bean Beetle in Florida.**—*Florida Ent.* **26** no. 1 pp. 1–8, 12 refs. Gainesville, Fla., 1943.

The following is substantially the author's summary. The first known infestation of *Epilachna varivestis*, Muls., in Florida was discovered on beans at Monticello on 20th May 1933. It was eradicated during the summer, and there was no further evidence of the beetle in the State until 1938, when a second infestation was found at Havana, Gadsden County. This has persisted and caused some damage each year, and others have developed in Gadsden and neighbouring counties. In 1942, three isolated outbreaks were found in Alachua County, more than 125 miles from any other known infestation. The beetle has not become established in those parts of the State that are presumed to be ecologically better suited to its needs. Life-history studies at Gainesville in 1942 showed that the eggs failed to hatch during hot weather, that larval mortality was very high, and that many of the adults then produced were badly malformed.

GINSBURG (J. M.). **Homemade concentrated and Tank-mix Oil Emulsions.**—*Circ. N. J. agric. Exp. Sta.* no. 455, 8 pp. New Brunswick, N.J., 1943.

In preparing home-made oil emulsions, a large quantity of a stable stock emulsion containing approximately two-thirds oil and one-third water may be prepared in the spray tank or by means of any other apparatus constructed for this purpose, and stored in drums from which the quantities needed for spraying are drawn, or the small amount of oil required for one full spray tank may be emulsified directly in the tank and mixed with the other spray ingredients ; the latter method is somewhat the cheaper. The author gives general directions for the preparation of concentrated emulsions, with formulae for dormant petroleum oil and tar oil emulsions, a combined tar and petroleum oil emulsion for delayed dormant spraying and a summer oil emulsion, and for the preparation of tank-mix oil emulsions, with formulae for dormant and summer oil emulsions. A description of the materials used and a list of the precautions to be observed are appended.

BLACKMAN (M. W.). **New Genera and Species of Bark Beetles of the Subfamily Micracinae (Scolytidae, Coleoptera).**—*Proc. U.S. nat. Mus.* **93** no. 3165 pp. 341–365, 2 pls., 3 refs. Washington, D.C., 1943.

This paper includes descriptions of one new genus and 11 new species from the United States and one new genus and five new species from other parts of America. The Scolytids of this group vary considerably in economic importance. So far as known, they all breed in the bark or wood of deciduous trees or shrubs. Those that breed in bark choose decadent or broken limbs or twigs, and though they may occasionally kill branches that might otherwise survive, may generally be classed as mildly beneficial in that they aid in the processes of decay. Species of the lignivorous genera *Hylocurus*, *Micracis* and *Thysanoes* are potentially more injurious and some cause actual damage ; *H.* (*M.*) *langstoni*, Blkm., which is common in the south-eastern United States, often attacks living trees through injured or dead areas of the bark, breeds in the wood below and by feeding on the adjacent living bark extends the injury until the entire tree is killed. Posts and poles set in the soil before being thoroughly seasoned are also often subject to heavy attack [*cf. R.A.E.*, A **11** 160], in which the entire sapwood may be riddled with larval mines filled with powdery frass.

VENABLES (E. P.) & WADDELL (D. B.). **The Influence of leguminous Plants on the Abundance of Tarnished Plant Bug.**—*Canad. Ent.* **75** no. 4 p. 78. Guelph, Ont., 1943.

The tarnished plant bug [*Lygus oblineatus*, Say], the overwintered adults of which damage apple and pear buds and peach fruits [*cf. R.A.E.*, A **30** 398] in British Columbia, is particularly abundant in orchards with permanent cover crops of red clover, sweet clover [*Melilotus*] or lucerne, and experiments were therefore undertaken in 1936 and 1937 to determine the influence of various types of leguminous cover crops on its abundance. The numbers of bugs swept from red clover, lucerne and white Dutch clover in small plots were 261, 71 and 24, respectively, in September–October 1936, when lucerne did not flower and was therefore not particularly attractive, and 725, 768 and 429 in June–November 1937. During late autumn, a few weeks before entering hibernation, the insects tended to congregate on the flower heads of the taller flowering plants ; 204 were taken on red clover, 177 on lucerne and 54 on white Dutch clover between 1st September and 1st November, none being found on the last after 8th October, probably owing to its low-growing habit and the relatively high humidity maintained under the dense matted growth. It might therefore be advisable to use white Dutch clover as a cover crop in orchards that are subject to attack by the bug.

LEPAGE (H. S.). **O percevejo das orquídeas.** [The Orchid Bug.]—*Biológico* **8** no. 3 pp. 67–72, 4 figs., 10 refs. São Paulo, 1942.

The Capsid, *Tenthecoris bicolor*, Scott, the nymph and adult of which are described, attacks orchids in cultivation and in the forest in Brazil, causing yellow spots on the leaves and necrosis. The bugs live for 4–6 months and are very voracious. All orchids collected should be examined for infestation, and infested plants should be dipped completely, except for the roots, into a solution of 2 oz. nicotine sulphate and 3 lb. soap in 10 gals. water.

LEPAGE (H. S.). **A "cochonilha branca" das amoreiras,** *Pseudaulacaspis pentagona* **(Targ. Tozz.).** [The Mulberry Scale, *Aulacaspis pentagona.*]—*Biológico* **8** no. 4 pp. 105–109, 3 figs. São Paulo, 1942.

Mulberry trees are being planted extensively in São Paulo for the rearing of silkworms [*Bombyx mori*, L.]. They have few pests in this region, the chief being *Aulacaspis* (*Pseudaulacaspis*) *pentagona*, Targ., which also attacks many other plants. A brief account is given of the life-history of this Coccid ; it is parasitised by *Prospaltella berlesei*, How., and *Aphytis* (*Aphelinus*) *diaspidis*, How., but they afford little control under natural conditions. Infested trees should be sprayed with oil emulsion, directions for preparing which are given.

DE FIGUEIREDO jr. (E. R.). **Uma vespinha prejudicial às orquídeas,** *Eurytoma orchidearum* **(Westw.).** [A Eurytomid injurious to Orchids.]—*Biológico* **8** no. 5 pp. 136–138, 2 figs. São Paulo, 1942.

Eurytoma orchidearum, Westw., the larva and adult of which are briefly described, infests orchids of the genus *Cattleya* at Santos. The female lays its eggs in the base of the floral pseudobulb, and the larvae feed in it, destroying the floral parts. Development from oviposition to adult emergence lasts 50–60 days. Infestation can be controlled by the destruction of parts showing signs of injury, or by injecting nicotine sulphate into the cavity containing the larva or pupa, or piercing it. In the United States, fumigation with hydrocyanic acid gas and the use of poison-baits are stated to have given good results against the adults.

MONTE (O.). **Uma lagarta dos arrozais.** [A Caterpillar of Rice-fields.]—*Biológico* **8** no. 6 pp. 161–163, 1 pl. São Paulo, 1942.

Much of the information in this account of the bionomics of *Elasmopalpus lignosellus*, Zell., on rice in São Paulo has already been noticed [*R.A.E.*, A **28** 378]. The female lays about a hundred eggs singly on the leaves and stems of the plants. Pupation takes place in the ground in a cocoon covered with earth and vegetable débris. All stages are briefly described. The pupal stage lasted 10 days in the laboratory in December.

DA FONSECA (J. P.). **Mandarová da mandioca.** [The Cassava Caterpillar.]—*Biológico* **8** nos. 7–8 pp. 179–186, 210–215, 8 figs. São Paulo, 1942.

Erinnyis ello, L., causes serious injury to cassava in São Paulo in some years by feeding on the leaves, petioles and young shoots, and was particularly numerous in 1940–41. All stages and the distribution of this Sphingid are described. The egg, larval, prepupal and pupal stages last 4–6, up to 15, 2 and 16–18 days, respectively, and the females lay up to 30 eggs, mostly on the leaves. The larvae pupate under débris or in the soil. They can be controlled by sprays of lead arsenate or Paris green with a suitable adhesive, hand collection and shallow trap-ditches covered with branches, which attract them when they are seeking a place to pupate. The larvae are parasitised in various parts of Brazil by a Sarcophagid of the genus *Oxysarcodexia*, a Tachinid, Braconids of the genus *Apanteles*, and Chalcidoids, and are also destroyed by *Calosoma retusum*, F., *Alcaeorrhynchus grandis*, Dall., wasps of the genus *Polistes* and birds.

Lepage (H. S.). **Aboboras, cobaias para o estudo das pragas dos vegetais.** [Squashes as Guineapigs for the Study of Pests of Plants.]—*Biológico* **8** no. 9 pp. 221–224, 2 pls. São Paulo, 1942.

The ripe fruits of various varieties of squash have proved excellent for maintaining Diaspine Coccids in the laboratory in Brazil and have been used in investigations of the effect on them of predators, parasites, entomogenous fungi, bacteria, contact insecticides and fumigants. The Coccids with which the fruits were infested comprise *Aonidiella aurantii*, Mask., *Chrysomphalus ficus*, Ashm., *Aspidiotus* (*Hemiberlesia*) *lataniae*, Sign., *A.* (*H.*) *rapax*, Comst., *Aulacaspis* (*Pseudaulacaspis*) *pentagona*, Targ., *C.* (*Acutaspis*) *scutiformis*, Ckll., *C.* (*Melanaspis*) *paulista*, Hemp., and *Fiorinia fioriniae*, Targ. Coccids of other subfamilies did not become established. The fruits are infested directly or by fastening pieces of infested material on them by means of adhesive tape. Besides whole fruits, which last for up to a year, it is possible to use pieces, which have kept in satisfactory condition for over two months when the cut surfaces were coated with melted paraffin wax.

Autuori (M.). **O enxôfre no combate às saúvas e outras formigas cortadeiras. (Baixo rendimento em anidrido sulfuroso nas combustões de enxôfre e carvão.)** [Sulphur in Work against *Atta* spp. and other Leaf-cutting Ants. (Low Production of Sulphur Dioxide when Sulphur and Charcoal are burned together.)]—*Biológico* **8** no. 10 pp. 249–251. São Paulo, 1942.

One of the commonest methods of controlling leaf-cutting ants of the genera *Atta* and *Acromyrmex* in Brazil is to introduce into their nests the gases produced by burning sulphur and white arsenic on glowing charcoal in a special apparatus [*cf. R.A.E.*, A **15** 68; **23** 750]. Though effective in the laboratory, the treatment usually has to be repeated several times in the field. In laboratory tests, the author found that the sulphur dioxide produced by burning sulphur alone killed all the ants in sections of nests in a few minutes, that arsenic alone required several hours, and that a mixture of sulphur and arsenic was no more effective than sulphur alone. In field work, however, burning sulphur alone with charcoal in the apparatus almost always gave negative results, and it appeared that this was due to the charcoal taking almost all the supply of oxygen, since most of the sulphur was deposited in the nests uncombined. It is recommended therefore that the sulphur should be burned without other combustible materials.

Lepage (H. S.) & Monte (O.). **As cigarrinhas do capim "kikuio".** [The Froghoppers of Kikuyu Grass.]—*Biológico* **8** no. 10 pp. 255–259, 3 figs. São Paulo, 1942.

The Cercopids, *Tomaspis flavopicta*, Stål, and *T. humeralis*, Lep. & Serv., the adults of which are briefly described, feed on and sometimes destroy kikuyu grass [*Pennisetum clandestinum*] in various parts of Brazil. The adults attack the leaves, and the masses of froth containing the nymphs are found on the basal part of the plant, usually at soil level. Various species of *Tomaspis* are common on *Andropogon*, *Paspalum* and *Panicum* in the Amazon region, but *T. flavopicta* did not attack *Andropogon rufus* or *Paspalum conjugatum*, though adjoining fields of *Pennisetum clandestinum* were completely destroyed. No parasites of the froghoppers have been observed, but the entomogenous fungi, *Metarrhizium anisopliae* and *Empusa* sp., were found to develop on them under favourable conditions in the laboratory. They can be destroyed by soaking the soil with a 1 per cent. emulsion of carbon bisulphide, but its use is not practicable on large areas.

de Toledo (A. A.). **Janela coletora de vespa de Uganda.** [A Window Collector for *Prorops nasuta*.]—*Biológico* **9** no. 4 pp. 79–83, 2 figs. São Paulo, 1943.

Stocks of the introduced Bethylid [*Prorops nasuta*, Wtstn.] for release in Brazil against the coffee berry borer [*Stephanoderes hampei*, Ferr.] are commonly obtained by collecting the parasites that emerge from infested material in an insectary. They are phototropic, and details are given of a device whereby they are caught in a collecting tube placed at a window so screened that the light is brightest at the tube.

Squire (F. A.). **Phototropism in Insects—an Indictment of the Light-trap Method.**—*Bull. ent. Res.* **34** pt. 2 pp. 113–116. London, 1943.

The author points out that field experiments with light-traps cannot show differences in the phototropic reactions of insects, since they take no account of the density and distribution of the species in the vicinity of the trap. They also fail to show the distance from which particular insects may have come, the speed at which they fly to the light, and whether some may fly towards the light and stop before they reach it. He describes experiments with laboratory-bred adults of *Platyedra gossypiella*, Saund., that demonstrated the influence of fatigue (loss of phototropic potential) as a result of exposure to a light. The moths were released singly into one end of a glass tube, 8 ft. long and 2 ins. in diameter, at the other end of which was a light of constant intensity, and the distance travelled by each in a given time was recorded. The results were at first inconsistent, as individuals were attracted, repelled or showed no reaction, but repeated tests on one moth showed that fatigue rapidly set in so that it no longer responded to the light. Three experiments were therefore carried out with moths that were kept in the dark until required for testing, and they all indicated that exposures resulted in a rapid failure to respond to light. Of five unmated females that were tested for 30 seconds four times between 9.30 and 10.15 p.m., none responded at the fourth exposure, and three showed no response after the first, but when the experiment was repeated 50–53 hours later, all again moved towards the light, though the average distance travelled during the first exposure was reduced. When five females and four males that had emerged 48 hours previously were tested before and after being exposed for 15 minutes near the light, the mean distance travelled was reduced from 64·4 to 4·1 ins. Experiments in which 15 short-cycle females were tested before and after rest periods of 60, 75 and 90 minutes, respectively, appeared to indicate that the extent of recovery from fatigue is proportional to the period of rest, though the differences in recovery were very small.

Compere (H.). **A new and economically important Species of** *Anagyrus* **from Africa.**—*Bull. ent. Res.* **34** pt. 2 pp. 129–130. London, 1943.

Le Pelley (R. H.). **The Establishment of a new Species of** *Anagyrus* **in Kenya.**—*T. c.* pp. 131–133.

Anagyrus beneficians, sp. n., is described in the first paper from adults of both sexes reared from *Pseudococcus kenyae*, Le Pelley, in Uganda in 1938 and subsequently in the laboratory at Nairobi. Characters are given distinguishing this Encyrtid from eight other species of *Anagyrus* with which it might be confused.

The second paper comprises an account of its introduction into Kenya and its establishment there as a parasite of *P. kenyae*, which is a serious pest of coffee and other crops [*R.A.E.*, A **26** 592]. Although present in several areas in Uganda, *A. beneficians* appeared to be of relatively little importance there. It was the most prolific of nine primary parasites of *P. kenyae* from Uganda that were bred in the laboratory [**28** 309]. It was reared by several methods, the standard one being in lamp glasses containing potato shoots infested with the mealybug ; 296,928 examples were reared in 1938–42, and it comprised 174,729 of a total of 800,000, parasites of all species liberated against *P. kenyae* during that period. It became established over all the area infested by the mealybug in Kenya, which comprises several thousand square miles in the Central Province and includes a large part of the coffee-growing districts and very extensive native reserves. It has been recovered several miles from any liberation point and mealybugs heavily parasitised by it have been taken in apparently isolated areas as far as six miles from the nearest point of release.

P. kenyae has been markedly reduced as a result of the liberation of parasites. The most important of five liberated on a large scale is another species of *Anagyrus*, closely allied to *A. kivuensis*, Comp., which has suppressed heavy infestations of *P. kenyae* in 6–8 months, maintains itself on small populations of the host and spreads rapidly. It apparently differs from *A. beneficians* in its response to minor differences in habitat, so that the latter is at times dominant even when the two species occur together. In the native reserves, where cultivated areas are often scattered among indigenous vegetation on which *P. kenyae* is present, *A. beneficians* is frequently the most abundant parasite, whereas the other species is dominant in the large areas under coffee.

Nixon (G. E. J.). **A Synopsis of the Ethiopian and Indo-Malayan Species of *Microphanurus* (Serphoidea, Scelionidae).**—*Bull. ent. Res.* **34** pt. 2 pp. 135–144, 9 figs., 10 refs. London, 1943.

The author gives a key based on the females to the species of *Microphanurus* from the Ethiopian and Indo-Malayan regions that are represented by well-authenticated specimens in the British Museum, two of which he describes as new, and a list of these species and one other showing their synonymy, distribution and hosts. *M. carinifrons*, Fouts [*R.A.E.*, A **23** 356] is considered a synonym of *M. striaticeps*, Dodd, and *M. lemoleae*, Nixon [**24** 469] is transferred to *Telenomus*.

Howe (R. W.). **An Investigation of the Changes in a Bin of stored Wheat infested by Insects.**—*Bull. ent. Res.* **34** pt. 2 pp. 145–158, 6 figs., 21 refs. London, 1943.

An account is given of an investigation in southern England of the changes that occurred in 1½ tons of insect-infested wheat, with an initial average water content of 12·9 per cent., that was stored in an open iron bin from May 1941 until October 1942. At the beginning of the observations, a small form of *Calandra oryzae*, L., was the most abundant species ; *Rhizopertha dominica*, F., *Laemophloeus ferrugineus*, Steph., *L. minutus*, Ol., and *Oryzaephilus* (*Silvanus*) *surinamensis*, L., were present in small numbers, with a few examples of *C. granaria*, L., and *Lariophagus distinguendus*, Först.

The following is based largely on the author's summary. The presence of the insects in the grain resulted in increased temperatures and an accumulation of carbon dioxide, which eventually produced unfavourable conditions from which the adults escaped by migration. The larvae of *C. oryzae* and *R. dominica*, which were responsible for much of the heating and carbon dioxide, could not escape since they develop within the grains, and the production of heat and carbon dioxide therefore continued until they became adult or until their development slowed down or ceased. By November 1941 the wheat was heating near the surface and was heavily infested to a depth of 25 cm.; the concentration of carbon dioxide below this layer exceeded 10 per cent. During December, the hottest part of the grain was nearer the surface and reached a temperature of 37°C. [98·6°F.], exceeding that of the air by 27°C. [48·6°F.]. At the beginning of the month, the temperature became too high for *C. oryzae* and many adults left the bin. As a result of this and of the cold weather, the temperature fell rapidly and by the end of the month had reached air temperature; at this time, many insects were still alive. The cold weather during the winter destroyed *C. oryzae* and *R. dominica* and the carbon dioxide concentration accordingly fell rapidly, but it rose again in March, when very few living insects were present, presumably owing to an increase in the water content of the grain at the sides and surface of the bin resulting from the maintenance of a steep temperature gradient in the grain and to the respiration of micro-organisms. Conditions became suitable for insect activity in April, and an infestation consisting chiefly of *C. granaria* had started by May. This weevil had entered mostly from neighbouring bins, but some adults of *Laemophloeus ferrugineus* and *L. minutus* that had survived the winter were also present. The insects were confined to a surface layer 50 cm. deep by the carbon dioxide present deeper in the bin, and heating did not occur to any great extent. In October, the temperature was falling, after having reached a maximum of 27°C. [80·6°F.] in August.

The conditions arising in the bin resembled those in general storage, except that the use of an open-topped bin with air-tight sides and bottom caused a much greater accumulation of carbon dioxide than is usual. It is suggested that if grains infested by weevils are buried in the bulk, heating is likely to occur, whereas if infestation is superficial the grain may not heat. The part played by weevil larvae in the heating of grain is stressed. The regular examination for insects of samples of grain from deep in a bulk and the examination of all bulks of grain soon after their storage are recommended. Routine temperature and water-content readings should be made at points deep in the grain and about 10–20 cm. below the surface.

POSNETTE (A. F.). **Resistance of *Theobroma cacao* to *Sahlbergella* spp. on the Gold Coast.**—*Bull. ent. Res.* **34** pt. 2 pp. 159–162, 3 refs. London, 1943.

It has been observed in the Gold Coast that certain trees of cacao (*Theobroma cacao*) appear consistently to escape attack by *Sahlbergella theobroma*, Dist., and *S. singularis*, Hagl., and also that *S. theobroma* feeds mainly on seedlings and trees up to 6 years old, its attack on mature trees being confined almost entirely to the pods, whereas *S. singularis* prefers mature trees, on which it causes severe damage to the shoots [*cf. R.A.E.*, A **14** 570]. Three nymphs of *S. singularis* were, however, found on seedlings of cacao in February 1943 and nymphs and adults on those of *T. bicolor* in December 1942. When Capsids of both species were caged separately with unattacked shoots in a similar stage of growth, picked from old and young trees that were infested with their specific pest and arranged so that their foliage intermingled, neither species exercised any constant choice, though there was a tendency to congregate on individual shoots, possibly owing to a gregarious habit. Statistical analysis confirmed the absence of any significant choice. Similar tests were carried out with shoots from trees that were susceptible and apparently immune in the field, but again no difference was observed. A clone was then developed that is rarely attacked in the field and does not suffer serious damage. When plants of this selection were infested by hand, however, the Capsids fed normally on them.

JOURDAN (M. L.). **Observations sur la biologie de la cecidomyie destructive** (*Mayetiola destructor* **Say) au Maroc. (Deuxième note.)**—*Bull. Soc. Sci. nat. Maroc* **18** pt. 3–4 pp. 161–169, 6 graphs, 1 ref. Rabat, 1939. [Recd. 1943.]

An account is given of further observations [*cf. R.A.E.*, A **26** 640] in 1936–38 on the bionomics of *Mayetiola destructor*, Say, in Morocco. Adults of the aestivating generation emerged from 20th October to the end of January in 1936–37, with a peak from 1st December to 10th January, and to 20th January in 1937–38, when over 96 per cent. emerged between 1st November and 10th December and 60 per cent. between 10th and 20th November. Emergence occurred chiefly after wet weather and, if rainfall was adequate, was promoted by warmth ; the effect of rain was confirmed in the laboratory. Some aestivating larvae collected in June 1936 did not give rise to adults until November 1937. Crop rotation as a means of control can therefore be effective only if cereals are planted at intervals of not less than two years.

In 1937–38, the complete life-cycle lasted about 60 days in November–January, 50 in January–March and 40 in March–April; the durations of the various stages are shown in tables. In the laboratory, the life-cycle lasted a month at a constant temperature of about 21°C. [69·8°F.] in November, and 33 days at an average of 19°C. [66·2°F.] in February–March. Not more than four generations a year were obtained even under the most favourable conditions, and only three, if the adults were not allowed to pair until the peak of emergence. Three generations rarely develop in the field, because the adults from non-diapausing larvae of the second generation produced after aestivation emerge when the cereals are in ear, and their offspring usually fail to develop on plants so far advanced in growth [*cf. loc. cit.*]. None of these generations is complete, since larvae of all of them diapause.

HAMERSMA (P. J.). **The Influence of the Insecticides, Cryolite and Sodium Fluosilicate on the Quality and Fluorine Content of Oranges.**—*Sci. Bull. Dep. Agric. For. S. Afr.* no. 236, 50 pp., 69 refs. [Pretoria] 1943.

Heliothis armigera, Hb. (*obsoleta*, F.) has of recent years caused great damage to oranges in South Africa. The eggs are laid in the blossoms and the larvae attack the small immature fruits. If they are not controlled at this stage and mature fruits of the preceding crop are still on the tree, as is frequently the case with Valencia oranges, the latter are also attacked and sometimes entirely destroyed. Since treatment with arsenicals reduces the acid content of the fruit for at least two seasons [*cf. R.A.E.*, A **27** 331], investigations were undertaken to determine whether dusts of cryolite and dusts and sprays of sodium fluosilicate, which are effective against the larvae, affect the quality of the fruit and whether fluorine is retained in or on the fruit after their use. Experiments were carried out in the Transvaal with Valencia and navel oranges in 1936–39. The insecticides had no harmful effect on the quality of the fruit as determined by the percentages of juice, peel, acid, and total soluble solids, the ratio of total soluble solids to acid and the vitamin C content, and did not affect the keeping qualities of fruit subjected to cold storage. No added fluorine was detected in the peel or fruit of mature oranges that had been treated when 5–10 mm. in diameter. The fluorine residues from treatments applied to mature Valencias shortly before harvest were rather high, and such fruit is not suitable for export or local consumption. Normal machine washing of export fruit in a packing house resulted in the removal of toxic amounts of fluorine, but the peel of such fruit still contained slight amounts of added fluorine. The residues from sodium fluosilicate did not adhere so firmly to the fruit as those from cryolite and were more satisfactorily washed off.

KRISHNA AYYAR (P. N.). **Biology of a new Ichneumonid Parasite of the *Amaranthus* Stem Weevil of South India.**—*Proc. Indian Acad. Sci.* Sec. B **17** no. 2 pp. 27–36, 13 figs., 7 refs. Bangalore, 1943.

Descriptions are given of all stages of an apparently undescribed species of *Xoridescopus* that is an ectoparasite of the larvae of *Hypolixus truncatulus*, F., in the stems of *Amarantus* in southern India and was first reared from them in 1940. Since a specimen of this Ichneumonid in a Coimbatore collection is stated to have been reared from a larva of *Alcidodes* (*Alcides*) *affaber*, Auriv., in *Hibiscus cannabinus*, larvae of several species of *Alcidodes* in various plants were offered to the females ; a few adults were obtained from some of them, but they had a very protracted pupal stage and laid few eggs.

The adults are active and positively phototropic. Males fed on sugar solution lived for 7–39 days, and females for 10–67. Larvae of *Hypolixus* in the late third instar and fourth instar were preferred for oviposition, and ordinarily a single egg was laid on any part of the paralysed host in the stem. The preoviposition and oviposition periods lasted 3–5 and up to 61 days, and the number of eggs laid per female averaged 16 and ranged up to 34. If two or more larvae hatched on the same host, not more than one survived to the second instar. The egg, larval, prepupal and pupal stages and the complete life-cycle lasted 1–2, 5–18, 3–5, 10–16 and 23–30 days, respectively. The mature larva spins a cocoon in the tunnel of the host, and the prepupa passes through an eonymphal and a pronymphal stage before moulting to the pupa. Eggs laid by unfertilised females gave rise to males only. The parasite has been observed only in November–March, and though never very numerous, is most abundant in December. The percentage parasitism is not high.

MILLER (L. W.). **Codling Moth in Williams' Pears. Investigation in the Goulburn Valley District—1936–41.**—*J. Dep. Agric. Vict.* **41** pts. 1 & 3 pp. 39–46, 141–148, 3 figs., 2 graphs, 15 refs. Melbourne, 1943.

Cydia pomonella, L., is a serious pest of Williams' pears in the Goulburn Valley, Victoria, and investigations on its bionomics and control there were carried out in 1936–41. The results obtained in the first two years have already been noticed [*R.A.E.*, A **26** 168 ; **27** 293], but the statement that second-generation adults did not occur in the orchard in 1936–37 was subsequently found to have been erroneous and resulted from confusion of moths of the first and second generations. Moths of the overwintered, first and second generations occurred in each year of the investigation, but the third-generation larvae do not find pears to infest unless the harvest is delayed.

The following is taken largely from the author's summary of the entire work as regards control. Catches of moths in the bait-traps were used as a basis for timing spray applications. When, however, the incubation period lasted a week or less, as in summer, these were found to be unsuitable for commercial use, even when daily records of catches were made. A more satisfactory method of timing by temperature and humidity data [**15** 532] would appear to be practicable for the Goulburn Valley. The timing and thoroughness of the applications were of major importance in determining the success of any spray schedule, and the effectiveness of the sprays against the first generation determined the necessity or otherwise of later ones. A calyx and two cover sprays were normally required against the first brood ; the calyx spray should be applied at petal-fall and not delayed for 10–14 days, and the two cover sprays at periods of maximum oviposition. The most economically efficient concentration of lead arsenate was 2½ lb. per 80 gals. water ; unsatisfactory results were obtained when a spreader was used, owing to the excessive run off and the rapidity with which the deposit weathered, and the addition of nicotine sulphate in the cover sprays did not improve the control. Cover sprays of white oil emulsion at 1 : 60 did not decrease infestation as compared with less expensive schedules in which lead arsenate was used throughout the season, but the emulsion improved lead-arsenate sprays even when as little as 1 pint per 80 gals. was added. When the quantity was increased to 4 pints, highly satisfactory results were obtained, but the use of more did not result in a corresponding increase in control. Mixtures of 2½ lb. lead arsenate and 4 pints white oil per 80 gals. should be used in both the cover sprays against the first brood and, if infestation is heavy, throughout the season until it has been reduced.

DAVIDSON (J.). **On the Speed of Development of Insect Eggs at constant Temperatures.**—*Aust. J. exp. Biol. med. Sci.* **20** pt. 4 pp. 233–239, 3 figs., 16 refs. Adelaide, 1942.

When the reciprocals of the time required for the eggs of an insect to develop and hatch at given temperatures are plotted against temperature, the distribution of the points forms a sigmoid curve. The author gives an exponential equation that provides a satisfactory empirical representation of this, the suitability of which was determined by the analysis of data for nine species of insects. The extent to which the calculated curve conforms to the published data for eggs of *Microbracon hebetor*, Say (*Habrobracon juglandis*, Ashm.) [*R.A.E.*, A **21** 377], *Austroicetes cruciata*, Sauss. [**30** 511] and *Drosophila melanogaster*, Mg., is discussed ; agreement is good over a range of temperature extending from the lowest at which development to hatching takes place to that at which it proceeds most quickly (peak temperature) and covering 82·7–90 per cent. of the total range. The straight-line temperature-velocity curve [**16** 642] and the catenary curve [**21** 378] are considered to be less accurate for determining the rate of development at given temperatures.

An examination of graphs illustrating the relation between rate of development and temperature in *Popillia japonica*, Newm., in a paper already noticed [**20** 280] indicates that the formula can also be used for the active stages of insects.

PESCOTT (R. T. M.). **The Azalea White Fly in Australia.**—*J. Aust. Inst. agric. Sci.* **9** no. 1 pp. 29–30, 1 fig., 6 refs. Sydney, 1943.

An Aleurodid found injuring azaleas in Victoria has recently been identified as *Aleurodes azaleae*, Baker & Moles, which has not previously been recorded from Australia. It has been observed only on two varieties of *Rhododendron mucronatum*, and it breeds continuously throughout the summer on the hairy lower surfaces of the leaves. It produces such large quantities of honeydew that infested plants are covered with a sooty mould by autumn ; spring flowering, however, is not seriously interrupted. Emergence of adults begins in November and apparently ceases in February. No parasites were found, and repeated attempts to use *Encarsia formosa*, Gah., reared from *Trialeurodes vaporariorum*, Westw., were unsuccessful. Satisfactory control was obtained with a spray of 1 pint white oil and 1 oz. nicotine sulphate in 5 gals. water, directed upwards into the plant.

LLOYD (N. C.). **Protection of Seed Potatoes from Moth Damage.**—*Agric. Gaz. N.S.W.* **54** pt. 3 p. 103. Sydney, 1943.

Since derris is now difficult to obtain, the author recommends that the 25 per cent. derris dust usually applied in New South Wales to protect seed potatoes from the potato moth [*Gnorimoschema operculella*, Zell.] during storage [*cf. R.A.E.*, A **31** 184] should be replaced by one of 5 per cent. pyridine in kaolin, which is effective and much cheaper. Methods of applying the dust so as to obtain a thorough and even coating are described. Pyridine should not be applied to table potatoes, since it taints the tubers.

Wood Borers in Australia. Part 3. Pin-hole Borers.—*Trade Circ. Div. For. Prod. Coun. sci. industr. Res. Aust.* no. 25 (2nd edn. revd.), 14 pp., 5 figs., 1 ref. Melbourne, 1939. [Recd. 1943.]

This part of a series on wood borers in Australia [*cf. R.A.E.*, A **21** 184] contains descriptions of the pin-hole borers, which comprise Platypodids and Scolytids (ambrosia beetles) and Lymexylonids, and the damage they cause to green timber, with a general account of their bionomics. The types of timber attacked and conditions for attack are discussed, and methods of eradicating or preventing infestation are given. A table showing the distinguishing characters of the chief groups of wood-boring beetles is repeated.

Termites (White Ants).—*Trade Circ. Div. For. Prod. Coun. sci. industr. Res. Aust.* no. 36 (2nd edn. revd.), 19 pp., 6 figs., 1 ref. Melbourne, 1942.

An account is given of the bionomics of termites in Australia, the damage they cause to timber and methods of preventing and controlling infestation [*cf. R.A.E.*, A **30** 103]. A list of common Australian timbers that are resistant to attack and a table showing means of distinguishing termite damage from that of various wood-boring beetles are included.

KEY (K. H. L.). **The Outbreak of the Australian Plague Locust** (*Chortoicetes terminifera* **Walk.) in the Season 1939–40, with special Reference to the Influence of Climatic Factors.**—*Bull. Coun. sci. industr. Res. Aust.* no. 160, 40 pp., 9 figs., 6 refs. Melbourne, 1943.

The following is largely based on the author's summary of this report, in which the outbreak of *Chortoicetes terminifera*, Wlk., that occurred in New South Wales in 1939–40 is analysed by the methods already described [*R.A.E.*, A **30** 420] and the analysis extended to Queensland, where a locust information service has recently been established. The outbreak was of moderate severity in New South Wales, where 89,300 sq. miles were infested and 1,507 swarms recorded ; in Queensland 484 swarms were recorded infesting an area of 50,700 sq. miles. In New South Wales the swarms originated partly from eggs laid by swarms of the previous season, and partly by new aggregation in outbreak areas. The first generation developed under favourable conditions, but drought prevented the second and third generations from developing in swarm formation and restricted the infested region to the north-eastern part of New South Wales. In Queensland, the swarms originated entirely by aggregation in outbreak areas, and the outbreak in south-eastern Queensland was terminated by heavy rains. Owing to the comparatively slight amount of forest clearing that has been carried out in Queensland, the infestation area, within broad climatic limits, coincides largely with the region of naturally treeless plains and downs. An extension of clearing may be expected to render much larger areas liable to infestation. Interchange of swarms between New South Wales and Queensland is, apparently, frequent ; in April 1940, infestation of three areas in New South Wales was suspected to have been due to migration of flying swarms from areas about 400 miles distant. The prevailing direction of flight in New South Wales and in south-eastern Queensland was south-easterly, as in previous seasons, but evidence has been obtained of a reversal of the usual direction when conditions become too humid, the swarms then moving towards drier regions.

Data regarding the limiting conditions in 1939–40 were in general agreement with the curve of limiting conditions established from a study of the outbreaks of 1937–39, but the whole curve must be regarded as only approximate. During 1939–40, two months was the maximum period on the dry side of the favourable zone that was tolerated by the eggs without high mortality. Two climatically unfavourable months in succession lead to very high mortality, with a consequent reduction in the area infested. In New South Wales, aggregation into swarms took place in 1939–40 in those outbreak areas in which relatively high values for the climatic index (over 73 [*cf.* **30** 102]) had been developed during 1938–39. The regions where the infestation was densest and where the largest number of generations was passed were, in general, those where the climatic index for the current (1939–40) season was high (over 73). Moreover, in these regions the longest sequence of too-dry months, and the number of too-wet months, were both low. These two measures can be used to indicate the degree of unfavourableness of a season, while the climatic index is a measure of its favourableness. Neither relationship, however, is sufficiently exact to permit accurate forecasts being made.

BIRCH (L. C.) & ANDREWARTHA (H. G.). **The Influence of Weather on Grasshopper Plagues in South Australia.**—*J. Dep. Agric. S. Aust.* **45** no. 9 pp. 95–100, 2 figs., 2 refs. Adelaide, 1941. [Recd. 1943.]

The most recent outbreak of *Austroicetes cruciata*, Sauss., in South Australia lasted from 1935 to 1940 [*cf. R.A.E.*, A **28** 332]. In 1940, drought killed vegetation, and most of the grasshoppers died before they reached the egg-laying stage, thus bringing the outbreak to an end. The years and localities in which grasshoppers were reported to have caused damage in South Australia since 1874 are given in a table, and it is shown by an examination of meteorological records for the years 1890–1940, made by the method previously described [**28** 593], that droughts as unfavourable to grasshoppers as that of 1940 occurred four or five times. It is believed that damage to pastures and crops from grasshoppers, even though extensive, may not be serious in a year when rainfall in winter and spring is above the average, but further work is required to determine whether excessive wetness either in winter or in spring will destroy the grasshoppers.

VOLKONSKY (M.). *Podapolipus diander* **n. sp. acarien hétérostygmate parasite du criquet migrateur** (*Locusta migratoria* **L.**).—*Arch. Inst. Pasteur Algérie* **18** no. 3 pp. 321–340, 6 pls., 3 figs., 7 refs. Algiers, 1940. [Recd. 1943.]

Detailed descriptions are given of the first and second (adult) stages of the female, the internal anatomy of the adult female and the two forms of the male of *Podapolipus diander*, sp. n., a Tarsonemid found as an external parasite on *Locusta migratoria*, L., in Algeria. On locust hoppers of the first three instars, only young females of the mite are found, mainly under the posterior extension of the pronotum. On hoppers of the fourth and fifth instars, the mites attach themselves to the parts covered by the rudiments of the elytra and wings, where the first eggs are laid. When the hopper moults, the young mites of both sexes that have hatched from the eggs and the females that have not yet engorged and oviposited leave the exuvia and attach themselves to the host again. On the adults, the mites are found mainly in the fold separating the mesothorax from the metathorax, but also on other parts of the thorax covered by the elytra, on the underside of the elytra near the base, and along the main veins of the wings, principally on the underside. Here the first-stage females transform into adults, which mature rapidly, and each produces parthenogenetically an egg from which a " small " male hatches immediately. This male pairs with the female, and the latter then oviposits, laying one egg every three hours at first and one every hour later. The eggs hatch in 5–6 days and produce females and " large " males. The males live as parasites on the females by perforating the abdominal surface, and, if numerous, sometimes kill them in this way.

The first-stage females attach themselves to the intersegmental membranes of the host, feed by perforating its integument, and gradually migrate along the abdomen towards the posterior segments and concentrate particularly between the genitalia. When the locusts pair, the mites pass from one to the other. During oviposition by the locust, some mites are engulfed in the secretion forming the egg-pod ; they do not, however, pass into the latter, and the mites often found feeding on the eggs are Trombidiids. Many of the mites leave the host at night if the temperature rises to about 27°C. [80·6°F.] and crawl either into crevices in the soil, or, more often, to the extreme points of plants, particularly to the tips of the ears of grasses, where they remain attached by their posterior legs with the anterior pair extended into the air. They attach themselves to any object that comes in contact with their extended legs, and if the latter happens to be *L. migratoria* the cycle is continued, but on any other insect they finally succumb, as invariably happened in all experimental attempts to infest Acridids other than *L. migratoria*. Attachment to other insects may, however, aid the dispersal of the mites. It is possible that they can feed also on vegetable juices and thus survive for a short period on plants. Since 2–3 generations of *L. migratoria* are produced in the Algiers region during the warm season and hibernation occurs in the adult stage, the mites may develop continuously in summer and pass the winter either as eggs or as first-stage females attached to the host.

VOLKONSKY (M. A.) & VOLKONSKY (M. T.). **Une mission d'étude des acridiens dans la Colonie du Niger (Aïr et Tamesna) et le Sud algérien (Hoggar) (26 septembre 1939–8 janvier 1940). ([Deuxième] rapport préliminaire.)**—*Arch. Inst. Pasteur Algérie* **18** no. 1 pp. 43–62, 18 pls., 5 refs. Algiers, 1940. [Recd. 1943.]

VOLKONSKY (M. A.) & VOLKONSKY (M. T.). **Une mission d'étude des acridiens dans le Sahara algérien (janvier-juin 1940). (Troisième rapport préliminaire.)**—*T.c.* no. 3 pp. 341–351, 19 pls., 4 refs. Algiers, 1940. [Recd. 1943.]

VOLKONSKY (M. A.). **Une mission d'étude de** *Schistocerca gregaria* **Forsk. ph.** *solitaria* **dans le Sahara central (Hoggar, Asegrad, Ahnet). Novembre-décembre 1940. (Quatrième rapport préliminaire.)**—*Op. cit.* **19** no. 2 pp. 313–325, 6 pls., 1 map, 6 refs. Algiers, 1941. [Recd. 1943.]

VOLKONSKY (M. A.) & VOLKONSKY (M. T.). **Une mission d'étude de la sauterelle pèlerine (***Schistocerca gregaria* **Forsk.) dans le Sud algérien et le Soudan français. Février-décembre 1941. (Cinquième rapport préliminaire.)**—*Op. cit.* **20** no. 1 pp. 102–114, 4 pls., 4 refs. Algiers, 1942.

These are the second and subsequent reports [*cf. R.A.E.*, A **28** 325] of work on *Schistocerca gregaria*, Forsk., in the Sahara, French Sudan and Niger Colony. It is stated in the second that adults of the second generation produced in May–June 1939 [*cf. loc. cit.*] left the areas north of the Hoggar mountains during July, except for a few restricted localities, such as the palm gardens of In Salah, where isolated individuals remained throughout the summer. At the same time, locusts appeared in the southern part of the Tamesna area where annual vegetation had become well developed, and breeding occurred in August. In October, breeding also occurred further north in the northern Tamesna and in the Aïr, and a northward movement of young adults, isolated or in small groups, developed. In December, the bulk of the locust population was concentrated in the Hoggar region, where breeding occurred in some favourable localities. No locusts remained in the Niger colony, except very sparse populations in certain more humid localities where breeding continued. On the whole, two overlapping generations were produced between August and December 1939, one in August–October and the other in October–December.

The third report deals with the adult swarms that migrated northward at the end of 1939 and reached the Tidikelt area. The movement was not resumed in the spring, and no breeding was observed, owing to dryness, except in a small area where local rains produced suitable conditions in February. A comparison of the distribution of locusts during three successive winters suggests that the bulk of the population migrating northwards concentrates in the Tidikelt and Tademait areas, and only isolated individuals penetrate further to the northern limits of the Sahara. The " migratory impulse " of locusts in the solitary phase seems to be insufficient to carry them to the northern zone, where conditions would be favourable for breeding and which is usually reached by swarms of phase *gregaria*. Precipitation in the zone of the central Sahara, between approximately 21 and 29°N. lat., therefore appears decisive for the breeding of the immigrant individuals of phases *solitaria* or *congregans*, and data from that zone would be important for forecasting outbreaks. Since dry conditions in the spring of 1940 prevented breeding, only restricted numbers of adult locusts left the central Sahara for the south in the early summer.

It is stated in the fourth report that at the end of the autumn of 1940, breeding occurred in the same areas as in 1939, but was more scattered, and the locusts were of phase *solitaria*. Thus, the dry spring of 1940 caused a general reduction in the population of *S. gregaria* in the Sahara and a return to the solitary phase after the incipient swarming of 1939 [*cf. loc. cit.*].

Later in 1940, as described in the fifth report, the September rains caused breeding in some localities, but this generation still belonged to phase *solitaria*. Later rains in the central Sahara had no effect, as low temperatures precluded breeding. When breeding was resumed in February–March 1941, it was inhibited by dryness of the soil in the central Sahara, where spring precipitation was deficient ; precipitation was abundant in the northern Sahara, but this area was not reached by the locusts, with the exception of the Saoura region. Spring breeding, therefore, occurred only in restricted areas and, in some cases, it led to the appearance of hoppers of phase *congregans*. The resulting adults, however, dispersed without forming swarms. At the end of June and in July there suddenly appeared swarms of young locusts that approached closer to phase *gregaria*, and they migrated to the southern limits of the Sahara. Their origin could not be ascertained, but they apparently belonged to the spring generation. Breeding at the end of the summer took place in the southernmost part of the Sahara and led to an increase in the population, but not to a further approach to phase *gregaria*. In the autumn of 1941, swarms of the summer generation were scattered over the central Sahara, but they did not produce an autumn generation.

The reports include very detailed descriptions of the types of vegetation, soil, climate, etc., in the respective areas visited, as well as numerous observations on the bionomics of *S. gregaria*, and tables showing the measurements of the adults.

HUDSON (J. R.). **Some Notes on the Army-worm Invasion of the Nairobi District in March, 1940.**—*J. E. Afr. nat. Hist. Soc.* **17** no. 1–2 pp. 125–127, 1 pl. Nairobi, 1943.

Army-worms, of which the only two examples reared were *Laphygma exempta*, Wlk., occurred in great numbers near Nairobi in March 1940 and caused serious damage to pastures by feeding on grazing grasses. They were beneficial, however, in an area in which kikuyu grass (*Pennisetum clandestinum*) was growing in association with clover (*Trifolium johnstoni*), as the destruction of the grass favoured the clover, which is necessary for soil fertility and is easily choked if the grass becomes long. The kikuyu grass quickly revived, but most other grasses were completely destroyed.

It is believed locally that there is a connection between the migration of butterflies of the genus *Glycestha* and army-worm infestation. A migration of these butterflies occurred in July 1939, and if the Noctuid migrated to Nairobi at that time it is probable that a small brood of larvae developed there later in the year and that the larvae observed in 1940 were the offspring of this generation.

Hinton (H. E.). **Natural Reservoirs of some Beetles of the Family Dermestidae known to infest Stored Products, with Notes on those found in Spider Webs.**—*Proc. R. ent. Soc. Lond.* (A) **18** pt. 4–6 pp. 33-42, 24 refs. London, 1943.

This paper contains a brief summary of the Dermestids known to occur in the nests of solitary and gregarious bees and wasps, gregarious caterpillars, birds and rodents, and a more detailed account of the habits of a few species that live on the accumulations of dead insects found near the webs of some spiders.

Sala de Castellarnau (I.). **Bionomía de los insectos zoófagos y xilófagos de museos, herbarios y bibliotecas.** [Bionomics of zoophagous and xylophagous Insects of Museums, Herbaria and Libraries.]—*Bol. Soc. esp. Hist. nat.* **40** no. 7–8 pp. 361–390, 5 figs., 4 pp. refs. Madrid, 1942.

Notes based on the literature and the author's experience in various countries are given on the habits and in some cases control of insects that are harmful to insect and vertebrate specimens, books and papers, dried plant specimens and wooden museum equipment such as cases, bookshelves, etc. Many specimens in the insect collection of Navás in Saragossa, including types and undescribed material, have recently been destroyed by insects.

Wireworms and newly ploughed Grassland. A Report from the Advisory Entomologists' Conference.—*Agriculture* **50** no. 3 pp. 102–105, 3 refs. London, 1943.

Observations during 1942 on the damage caused to crops in Britain by wireworm populations of various sizes confirmed the conclusions reached in previous years [*R.A.E.*, A **30** 455]. It was found, however, that at each level of population the risk of poor yields from a susceptible crop has steadily decreased, and this is attributed to favourable seasons for growth and to improved cultivation. The odds for and against the production of successful crops of winter wheat and spring oats as a first crop after grass on land with wireworm populations of various sizes are given in a table. Linseed and flax again appeared to be the crops least susceptible to damage, and barley is recommended where a cereal is required on infested land, though it should not be sown if infestation is very severe. Wireworm damage to potato tubers increases with delay in lifting.

The average number of wireworms to be expected per acre after the first and second arable crops in fields that were originally under grass and supported populations of 0–300,000, 325,000–600,000, 625,000-1,000,000 and over 1,000,000 per acre are, respectively, 180,000 and 120,000, 360,000 and 170,000, 430,000 and 270,000 and 720,000 and 220,000. Observations in 800 fields showed that the average reduction in population during the first year after ploughing in fields that had initial populations of 1,000,000 and 250,000 wireworms per acre is 44 and 10 per cent., respectively, and in arable fields with the same populations the reduction in a year is 69 and 40 per cent. As a rule, wireworms are unlikely to cause serious damage to crops other than potatoes after the second year of cultivation, but a basic population usually persists, even in fields that have been under cultivation for several years. Such a population is, however, unlikely to increase to injurious numbers in less than five years after cultivation is discontinued, and wireworms can therefore be reduced on heavily infested land by cultivating it and avoiding long leys. The effects of seeding rates and of measures to encourage the growth of cereals on infested land are discussed.

AHLBERG (O.). **Ett massuppträdande av jordflylarver.** [An Outbreak of Cutworms.]—*Växtskyddsnotiser* 1943 no. 3 pp. 1–4, 3 figs. Stockholm, 1943.

Cutworms caused serious injury to spring wheat, rye, oats and clover on a farm in Sweden in May 1943. In an experiment on control, a small plot of oats was dusted with a mixture of kieselguhr and 0·5 per cent. spores of *Metarrhizium* [*anisopliae*] at the rate of about 0·15 oz. per sq. yd. The weather during the experiment was dry and windy, so that some of the dust was blown away, but of 167 larvae collected from the plot two days later, 81 per cent. died within 12 days and all these contained hyphae of the fungus. A week after dusting, 224 larvae were collected from the plot, most of which had probably immigrated from the surrounding area, and 44 per cent. of these died within six days from infection by the fungus. Although the fungus is slow in action, the larvae cease to feed soon after becoming infected.

LARSÉN (O.). **Zur Biologie von** *Rhacognathus punctatus* **L.**—*K. fysiogr. Sällsk. Lund Förh.* **11** (1941) pp. 175–188, 2 figs., 6 refs. Lund, 1942.

The author states that little has been published on the biology of the predacious Pentatomid, *Rhacognathus punctatus*, L., which he observed in Sweden preying on larvae and adults of *Lochmaea capreae*, L., infesting *Salix caprea.* In the laboratory, flies and various Coleopterous and Lepidopterous larvae were also attacked. The eggs are laid in spring, and the nymphs apparently complete their development by the end of July. The adults overwinter, and there is only one generation a year. Descriptions of the five nymphal instars are given, together with a key to the nymphs of the five predacious Pentatomids that occur in Sweden.

Annual Report of the Imperial Council of Agricultural Research 1941–42.—vii+130 pp. Delhi, 1943.

In the section on entomology (pp. 37–38), it is reported that the San José scale [*Aspidiotus perniciosus*, Comst.] has been collected in Kashmir [*cf. R.A.E.*, A **30** 612] at altitudes of 3,500–7,600 ft. and is injurious on fruit trees between 5,000 and 7,000 ft., being most numerous near lakes and in other humid places, and that the woolly aphis [*Eriosoma lanigerum*, Hsm.], which occurs only on apple, is present between 4,460 and 7,600 ft. Root forms were generally absent. The scale was satisfactorily controlled with sprays containing approximately 6 per cent. diesel oil emulsified with soft soap, calcium caseinate, Bordeaux mixture or egg albumen and applied in good weather at any time in the winter; dormant sprays containing miscible oils or lime-sulphur were less effective, and heavy lubricating oil and light oil emulsions killed the plants. Oil emulsion with tobacco decoction or nicotine sulphate controlled both insects.

In the section on pathology (pp. 38–39), it is stated that *Bemisia tabaci*, Gennadius (*gossypiperda*, Misra & Lamba) became infected with the virus of yellow-vein mosaic of bhindi [*Hibiscus esculentus*] more rapidly if starved for at least two hours before feeding on the diseased plant, but even then it required to feed for at least 30 minutes to acquire the virus. It remained infective until death and transmitted the virus in feeding periods of 30 minutes or sometimes less. The incubation period of the virus in it was seven hours. This Aleurodid was the only insect of those tested that transmitted the virus of yellow mosaic of lima beans.

GHOSE (T. P.). **A Note on Derris and other Rotenone bearing Vegetable Insecticides, their Occurrence and Possibilities of Cultivation in India.**—*Indian For. Leafl.* no. 20, 9 pp. Dehra Dun, 1942.

The author briefly discusses from the literature the insecticidal constituents of derris root and the preparation from it of dusts and sprays and gives tables showing the contents of rotenone and other ether-soluble substances in 8 species of *Derris* that are indigenous in various parts of India and in *Millettia pachycarpa* from Assam and Bengal. The only species that might be of value as insecticides are *D. ferruginea* and *M. pachycarpa.* Their content of toxic constituents is relatively low, but might be improved by cultivation. Attempts are being made to grow *D. elliptica* and *D. malaccensis* from cuttings received from Malaya, and results with the former have been encouraging.

LOPEZ CRISTOBAL (U.). **La " filoxera " de la vid y sus formas de reproducción experimental.** [The Grape Vine *Phylloxera* and its Forms obtained in Experiments on Reproduction.]—*Bol. Lab. Zool. agríc. Fac. Agron. Univ. nac. La Plata* no. 7, [7] pp., 4 figs., 1 ref. La Plata, 1942.

Winged forms of *Phylloxera* (*Dactylosphaera*) *vitifoliae,* Fitch, were obtained experimentally at San Juan in 1939, and their abundance and ready oviposition under natural conditions in the laboratory there in February and March 1941 suggested that they may be the normal dispersal form on vines in the Cuyo district of Argentina.

In breeding experiments with material from San Juan at temperatures of from 2 to 40°C. [35·6–104°F.], the only forms obtained were parthenogeniae, which occurred at temperatures of from 6 to 36°C. [42·8–96·8°F.]. Winged parthenogeniae appeared at 26–35°C. [78·8–95°F.], but only when the wingless Aphids were numerous so that food was scarce. They appeared to feed, lived for up to six days, and laid up to five eggs in the root collar of the vine, protected by the bark. The eggs always produced normal wingless parthenogeniae, which crawl to the roots and re-start the cycle until temperature holds them in the hibernating form.

The author considers that the failure of these Aphids to produce sexuales is due to environmental factors and the lack of American vines on which to complete the cycle with the leaf-gall form, and that the complete cycle might appear under favourable conditions, since the leaf-gall form has been found on American vines in Argentina.

FRANKLIN (H. J.) & others. **The Cranberry Station, East Wareham, Massachusetts.**—*Bull. Mass. agric. Exp. Sta.* no. 388 (Rep. 1941) pp. 37–40. Amherst, Mass., 1942.

In 1941, about 50 acres of cranberry plants in Massachusetts were found to be infested by *Tlascala finitella,* Wlk., which did considerable damage from 12th July until 12th August. In Rhode Island, a heavy infestation occurred in cranberries that had been replanted in the spring [*cf. R.A.E.,* A **30** 458] and a lighter one in others that had been planted the previous year ; both were controlled by heavy spraying and dusting with materials containing rotenone. Unsuccessful attempts were made to infect larvae of *Amphicoma vulpina,* Hentz, with the type A milky disease [*cf.* **30** 122], by injection of the causal organism (*Bacillus popilliae*), by feeding them on it, and by allowing them to feed in infected soil. Plots on which paradichlorobenzene was spread at the rate of 1,200 lb. per acre in late spring and covered at once with about an inch of sand showed almost complete mortality of the larvae in late August, even where they had been flooded for frost protection and insect control soon after treatment. Xanthone as a spray or dust was ineffective against *Mineola vaccinii,* Ril., which was much less prevalent than in the previous year [*cf.* **30** 459] ; but a spray of lead arsenate (8 lb. per 100 U.S. gals. water with a casein spreader) gave good control on experimental plots, though it was less effective than derris or cryolite, when applied at the rate of 400 U.S. gals. per acre. Sprays of 14 lb. cryolite per 100 U.S. gals. water at the rate of 400 U.S. gals. per acre and dusts of 100 lb. natural cryolite per acre caused little reduction in the number of maturing larvae of *Lymantria* (*Porthetria*) *dispar*, L., on a cranberry bog ; 50 lb. per acre of derris dust (4 per cent. rotenone) killed nearly all the adults of *Crambus hortuellus*, Hb., which was more injurious than in the previous year, but was less effective than pyrethrum ; and a mixture of cryolite and impregnated pyrethrum dust was more effective than pyrethrum alone against the black-headed fireworm, *Rhopobota* [*naevana*, Hb.], which was less abundant than usual, and particularly against the first generation. Of the other insect pests of cranberry, the firebeetle, *Cryptocephalus* [*incertus*, Ol.], was generally very scarce, but abundant in one locality, the false armyworm, *Xylena* [*nupera*, Lint.], was more troublesome than for many years, and the cranberry spittle insect, *Clastoptera* [*saint-cyri*, Prov.], and tipworm, *Dasyneura* [*vaccinii*, Smith], were rather more troublesome than in 1940.

ALEXANDER (C. P.) & others. **Department of Entomology.**—*Bull. Mass. agric. Exp. Sta.* no. 388 (Rep. 1941) pp. 50–66, 3 figs. Amherst, Mass., 1942.

In investigations in Massachusetts in 1941 with dormant oil sprays for the control of overwintering eggs of the European red mite [*Paratetranychus pilosus*, C. & F.] on apple, commercial oil sprays containing dinitro-ortho-cyclohexylphenol caused no injury to fruit or leaf buds. They caused no retardation in development when the pH of the solution was 7·9 but caused noticeable retardation when it was 6·6. Oil sprays containing dinitro-ortho-cresol (pH 5·8 and 4·8) caused marked slowing down of bud development. The numbers of young mites per 100 spurs were 1,660, 675 and 465 after treatment with dinitro-o-cyclohexylphenol and dinitro-o-cresol in oil emulsion and oil emulsion alone, and 20, 80 and 15 after the two dinitro compounds in miscible oil and miscible oil alone, as compared with 13,055 on untreated trees. Mixtures of these compounds with oil (pH 8, 7·45 or 6·75), applied on 8th April, caused no noticeable injury to bark or twigs, but some retardation of bud development, which was rather greater after the more alkaline mixtures and after the dinitro-o-phenol ; all the sprays reduced the average number of living mites per spur on 30th April by at least 90 per cent. with no significant difference between treatments. Incidental records on the overwintering eggs of Aphids, including heavy infestations on birch and pine and moderate ones on several ornamental trees, showed practically complete kill following the use of dinitro compounds. None of the common deciduous ornamental plants showed ill effects, except for slight retardation in some cases ; moderate scorching was observed on Irish juniper [*Juniperus communis* var. *hibernica*] and more serious injury on laurel and rhododendron. Dormant application of a 5 per cent. commercial oil emulsion combined with dry-mix dinitro-o-cyclohexylphenol gave economic control of oystershell scale [*Lepidosaphes ulmi*, L.] on lilac and willow.

Paratetranychus pilosus was comparatively scarce on apple in midsummer and late summer, but a heavy outbreak was reduced by 82·5 per cent. in 24 hours and 98·1 per cent. in 8–9 days by dusting with a dicyclohexylamine salt of dinitro-o-cyclohexylphenol. In other orchards, spraying with a mixture containing 20, 24 or 30 oz. of a 20 per cent. mixture of the salt with a dispersing and wetting agent per 100 U.S. gals. reduced the infestation by an average of 94·2 per cent., with no significant difference between concentrations, and a 1·5 per cent. dinitro dust averaged 95·3 per cent. reduction when applied from both sides of the tree and 89·3 per cent. when applied from one side only. The first dust and a 20 per cent. dinitro spray caused no injury to 28 different fruit and shade trees and ornamental and garden plants that are subject to mite attack. A pyrethrum spray with a good wetting agent gave 97 per cent. control, rotenone sprays averaged 88·5 per cent., and a spray containing ricin, the toxic ingredient in castor-bean, was considerably less effective ; none of these sprays caused injury to the fruit, bark or foliage.

The apple maggot [*Rhagoletis pomonella*, Walsh] was relatively unimportant throughout most of the north-eastern States, probably owing to adverse weather conditions and especially deficient rainfall at the period of normal emergence. The apple leaf-curling midge [*Dasyneura mali*, Kieff.] was not reported outside the area known to be infested, but several new infestations were found within it. Infestation was very heavy during May and June, but below normal in late July and August, owing to the drought. Eggs were laid on 80·87 per cent. of the bud tips examined at 3–4-day intervals between 9th May and 12th September; oviposition was heaviest between 27th May and 10th June, 1st and 8th July and 22nd July and 5th August. The emergence of larvae from rolled leaves was concentrated in three short periods (17th–24th June, 8th July and 29th July); these corresponded with the rainfall rather than with the development of generations, which overlapped because of the abnormal weather. Of the larvae collected in June, July and August, 22·54, 45·41 and 11·11 per cent. transformed to adults in the same season [*cf. R.A.E.*, A **30** 459]. Naphthalene, broadcast at the rate of 2 lb. per 100 sq. ft., reduced the number of adults emerging from the soil and débris by 79 per cent. in the first generation and 97 per cent. in the second [*cf. loc. cit.*]. Larvae and pupae in cocoons under the rough bark on the tree trunks were killed by experimental spraying in April and July with 1 per cent. Elgetol [a preparation of sodium dinitro-o-cresylate] or with an emulsion containing 3 per cent. actual oil alone or with the addition of 15 oz. dinitro-o-cyclohexylphenol per 100 U.S. gals. The emergence of flies from mulch collected under trees after application of these sprays at the rate of 2 U.S. gals. per 100 sq. ft. indicated that Elgetol caused considerable mortality, and that the oil emulsion did not. The critical period of activity of the plum curculio [*Conotrachelus nenuphar*, Hbst.] on apples was 20th–23rd May; different trees were sprayed with lead arsenate on 20th, 22nd and 23rd May when the apples averaged four, five and six sixteenths of an inch in diameter, and the spray applied on 22nd May proved considerably more effective than the others.

Two undetermined parasites of the grape plume moth [*Oxyptilus periscelidactylus*, Fitch] were found, but the total parasitism in the larvae collected was less than 1 per cent. The addition of 15 oz. of a dinitro-o-cyclohexylphenol compound or dinitro-o-cresol per 100 U.S. gals. to a spray containing 3 per cent. oil, applied on 10th April, increased the percentage control from 74 to 86 and from 60 to 82, respectively; a commercial sodium dinitrocresylate gave 94 per cent. protection when used at a concentration of 1 per cent. and 88 per cent. when used at half that strength. Activity of the grape cane girdler [*Ampeloglypter ater*, Lec.] was first observed on 22nd May, when the maximum temperature was 89°F. The average life-cycle of 26 individuals in the vineyard was 60·8 days, emergence occurring chiefly between 15th and 25th August, but continuing until 22nd September. Adults were reared from 28 per cent. of the girdled canes under observation. Sprays applied when the average cane growth was 4 ins. or less prevented most girdling, but when the growth between sprays was about 8 ins., the number of girdled canes was 8-15 per cent. greater than on the unsprayed vines. Cryolite (3 lb. per 100 U.S. gals.) was more satisfactory than lead arsenate, which caused some foliage injury when applied frequently with sulphur or copper oxide.

The squash vine borer [*Melittia satyriniformis*, Hb.] was again unusually abundant [*cf.* **30** 460], and experimental sprays and dusts were applied on 7th, 14th, 21st and 28th July. The most effective were a dust of rotenone and copper oxychloride sulphate and sprays of nicotine sulphate (1 : 250) and of 1 per cent. white oil emulsion containing nicotine sulphate (1 : 500). Dusts containing 0·75 per cent. rotenone in talc or 20 per cent. cryolite with 5 per cent. metallic copper were moderately effective, and a spray of 3 lb. lead arsenate and 1 U.S. pint fish oil per 100 U.S. gals. water was ineffective. The yield was 80 per cent. higher on the plot treated with the best dust than on the untreated one.

Sifting the soil round the roots of cabbage, broccoli and turnip that had remained in the ground during the winter showed averages of 1·9, 4·9 and 19·9 pupae of the cabbage maggot [*Hylemyia brassicae*, Bch.] per 6 in. cube of soil on 18th April, indicating that late-planted cruciferous crops are one of the largest sources of the pest in spring. The plants had apparently been infested by the third generation in September. The first eggs were found on 1st May, and 85·72 per cent. commercial injury occurred in one variety of cabbage. The percentage commercial control and (in brackets) the percentage of large and medium heads were 92·04 (78) and 96·67 (83) after one and two applications, respectively, of corrosive sublimate [mercuric chloride] in water, and 100 (75) after a dust of 4 per cent. calomel [mercurous chloride] in talc, applied at the rate of 1 teaspoonful round the stem of each plant. Early-maturing varieties were most susceptible and red varieties most resistant. Both set- and seed-grown onions were comparatively free from thrips [*Thrips tabaci*, Lind.]. The results of tests with contact insecticides are given, but they are considered inconclusive in view of the scarcity of the thrips on unsprayed plants.

The only pest that caused injury to potatoes was the flea-beetle [*Epitrix cucumeris*, Harr.], which was abundant throughout June and early July, but decreased in late July. Of sprays applied 11 times between 11th June and 27th August, basic copper sulphate with sulphur, basic copper arsenate with sulphur and a neutral copper fungicide resulted in 103·1, 45·1 and 88·6 feeding punctures per sq. in. leaf surface, respectively. The damage was much less, however, on all plots sprayed with home-made Bordeaux mixture. The mixture made with half the quantity of lime was slightly the more effective, and the addition of calcium arsenate to either mixture gave added protection [*cf.* **30** 461]. Both the yield and the length of life of the plants were correlated with the amount of flea-beetle injury.

Owing to early emergence of adults of the overwintered generation of the European corn borer [*Pyrausta nubilalis*, Hb.], when the maize was too small to be attractive for oviposition, and low temperatures at dusk, infestation by the first generation was negligible throughout most of the north-eastern States. The percentages of uninjured ears in untreated plots and those treated with sprays of derris or fixed nicotine and dusts of derris or dual-fixed nicotine were 92·9, 99·4, 97·1, 99·4 and 98·8, respectively. Infestation by the second generation was so light that late maize in the experimental planting was not sprayed. On 12th August, some of this maize was treated with lubricating oil containing pyrethrum extract, applied to the dried silk of the ears for protection against the corn ear worm [*Heliothis armigera*, Hb.]; no infestation developed, but pollination of the kernels at the top of the ears was prevented.

Experiments against the red spider [*Tetranychus telarius*, L.] on greenhouse plants included tests of 11 proprietary preparations recommended as sprays for its control on roses. Much the best was one described as technical mannitan monolaurate to which 1 per cent. rotenone and 1·8 and 2·6 per cent. other derris extractives [*cf.* **30** 198] had been added. It gave 90 per cent. mortality without injuring the plants when diluted to 1 : 400 and satisfactory control when diluted to 1 : 600. Two sprays containing rotenone and emulsified dispersing oils reduced the infestation by 60–80 per cent., but the remainder were unsatisfactory. A dust containing 1 per cent. dinitro-o-cyclohexylphenol killed 90 per cent. of the mites without injuring the foliage when applied three times in March.

Elm logs that had been cut just before April 1941 were examined at the end of September. Some contained only large larvae of *Scolytus multistriatus*, Marsh., and no emergence holes, while others contained larvae, pupae and young adults of *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., and many emergence holes, suggesting that *Scolytus* may commonly have one generation a year in this locality (Alford), which is the one where Dutch elm disease was first found in

Massachusetts. Numerous feeding or overwintering tunnels of *H. rufipes* were observed in the tree that was first found to be infected, particularly near the base, and adults were active in the tunnels in the middle of September; there was no apparent correlation between the occurrence of these tunnels and the presence of the causal fungus, *Ceratostomella ulmi.*

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CONTENTS.

PAGE
Africa: The Species of *Microphanurus* ... 417
Africa: *Schistocerca gregaria* in the Sahara, etc., in 1939–41 ... 424
Africa, East: A new Parasite and biological Control of *Pseudococcus kenyae* ... 416
Africa, East: An Army-worm Outbreak in Kenya ... 425
Africa, North: The Bionomics of *Mayetiola destructor* in Morocco ... 419
Africa, North: A new Mite on *Locusta migratoria* in Algeria ... 423
Africa, South: The Influence of Cryolite and Sodium Fluosilicate on Oranges ... 419
Africa, West: Resistance of Cacao to *Sahlbergella* spp. in Gold Coast 418
Africa, West: Ants associated with Coffee in Belgian Congo (*Title only*) 432
America: New Genera and Species of Micracinae ... 413
Argentina: Investigations on a winged Form of *Phylloxera* ... 428
Argentina: The Bionomics of *Conotrachelus denieri* (*Title only*) ... 432
Australia: *Cydia pomonella* and its Control on Pears ... 420
Australia: An Aleurodid on Azalea in Victoria ... 421
Australia: Pyridine Dust against *Gnorimoschema operculella* in stored Potatoes ... 421
Australia: The Beetles that infest unseasoned Timber ... 422
Australia: Termites and their Control in Timber ... 422
Australia: Locust Outbreaks and the Effect of Weather on them 422, 423
Brazil: Insect Pests of Orchids ... 414
Brazil: *Aulacaspis pentagona* on Mulberry ... 414
Brazil: *Elasmopalpus lignosellus* on Rice in São Paulo ... 414
Brazil: The Bionomics and Control of a Sphingid on Cassava ... 414
Brazil: Sulphur Fumigation against Leaf-cutting Ants ... 415
Brazil: Cercopids infesting *Pennisetum clandestinum* ... 415
Brazil: A Trap for collecting reared Adults of *Prorops nasuta* ... 416
British Isles: Wireworms and newly ploughed Grassland ... 426
British Isles: A new Aphid on Rose (*Title only*) ... 432
Canada: Cover Crops and *Lygus oblineatus* in Orchards ... 413
Hawaii: Insect Pests that might be introduced into California ... 393
India: An Ichneumonid Parasite of *Hypolixus truncatulus* ... 420
India: Work on Orchard Pests and a Vector of Virus Diseases ... 427
India: A Note on Rotenone-bearing Plants ... 427
Indo-Malayan Region: The Species of *Microphanurus* ... 417
Paraguay: The Bionomics of *Conotrachelus denieri* (*Title only*) ... 432

CONTENTS—*cont.*

PAGE
Sweden: An Experiment with *Metarrhizium anisopliae* against Cutworms ... 427
Sweden: The Biology of *Rhacognathus punctatus* 427
U.S.A.: Work against *Cydia pomonella* and *Paratrioza cockerelli* in New Mexico 393
U.S.A.: Sprays against *Polychrosis* and *Erythroneura* on Vines 394
U.S.A.: A Pyrethrum Spray against *Macrodactylus subspinosus* 395
U.S.A.: Thallium Baits against *Solenopsis geminata* 395
U.S.A.: An Increase of Aphids on Potatoes sprayed with Zinc Arsenite 396
U.S.A.: Soy-bean Phosphatides in Sprays against *Cydia pomonella* ... 396
U.S.A.: Factors affecting Eggs of *Cydia pomonella* on Apple Trees ... 397
U.S.A.: Tests of Insecticides against Cotton Pests... 398
U.S.A.: Weather Factors and *Anthonomus grandis* in Louisiana... ... 399
U.S.A.: Mixed Dusts against *Macrosiphum onobrychis* on Peas 400
U.S.A.: Fumigation with Methyl Bromide against the Sweet-potato Weevil 401
U.S.A.: Laboratory Rearing of *Microbracon vestiticida* 401
U.S.A.: Dinitro-o-cyclohexylphenol and Sulphur against *Empoasca fabae* 402
U.S.A.: A White Grub injuring Ground-nuts in Virginia 403
U.S.A.: Parasitism of *Epitrix parvula* by *Microctonus epitricis* in Virginia 403
U.S.A.: Damage to Strawberries by *Blapstinus* in California 403
U.S.A.: *Epitrimerus pyri* on Pear in New York 403
U.S.A.: Physiological Races of *Macrosiphum onobrychis* 405
U.S.A.: Damage to Cherry by *Scolytus sulcatus* in New York 405
U.S.A.: Sex Ratios of Moths caught by different Methods 405
U.S.A.: Collection, Rearing and Release of Parasites of *Pyrausta nubilalis* 406
U.S.A.: *Gnorimoschema operculella* in Nebraska 406
U.S.A.: A Dried-fruit Moth in Nests of a Carpenter Bee 406
U.S.A.: Injury to Maize by *Dikraneura carneola* 407
U.S.A.: *Plagiotrochus suberi* on Cork Oak in California 407
U.S.A.: Parasites of *Cydia molesta* and of Weed-infesting Larvae ... 408
U.S.A.: Tests of Sprays against *Cydia pomonella* in New York 410
U.S.A.: Summer Control of *Paratetranychus pilosus* on Apple 410
U.S.A.: Strains of *Macrosiphum solanifolii* within a limited Area... ... 411
U.S.A.: Resistance to Tartar Emetic in *Scirtothrips citri* 411
U.S.A.: *Heliothrips haemorrhoidalis* on Oranges in California 412
U.S.A.: A new Species of *Homadaula* on *Albizzia* 412
U.S.A.: The Effect of War on the Insecticide Industry 412
U.S.A.: *Epilachna varivestis* on Beans in Florida 412
U.S.A.: Cranberry Pests in Massachusetts in 1941... 428
U.S.A.: Work against miscellaneous Pests in Massachusetts in 1941 ... 429
U.S.A.: Races of *Aceratagallia* and Potato Yellow-dwarf (*Title only*) ... 432
U.S.A.: Pests of Vegetables in Florida (*Title only*)... 432
U.S.A.: A Study of the Genus *Conotrachelus* (*Title only*) 432
The Toxicity of some contact Dusts to Aphids 395
Tests of Fumigants of the Nitroparaffin Group 402, 408
Volatile Fluorine Compounds as Fumigants 402
Nitriles as possible Fumigants for stored Grain 404
Effect of Humidity on Insecticides against *Cydia pomonella* 404
Effect of Vapour-heat Sterilisation on Eggs of *Anastrepha ludens*... ... 407
A Gas-tight Fabric for Fumigation Purposes 408
Industrial Fumigation against Insects 408
The Preparation of concentrated and Tank-mix Oil Emulsions 413
The Maintenance of Coccids on Squash Fruits in the Laboratory... ... 415
Fatigue in Phototropism of *Platyedra gossypiella* 416
Changes in a Bin of Wheat infested by Insects 417
The Speed of Development of Insect Eggs at Constant Temperatures ... 421
Natural Reservoirs of Dermestids 426
Insects injurious in Museums and Libraries 428
Colour Perception in Insects (*Title only*) 432
An Apparatus for testing Chemotropic Responses of Insects (*Title only*) ... 432
Killing and preserving Fluids for Insect Larvae (*Title only*) 432
Tyroglyphid Mites in Stored Products (*Title only*) 432
A Method of Pyrethrum Analysis (*Title only*) 432

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